



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

### Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

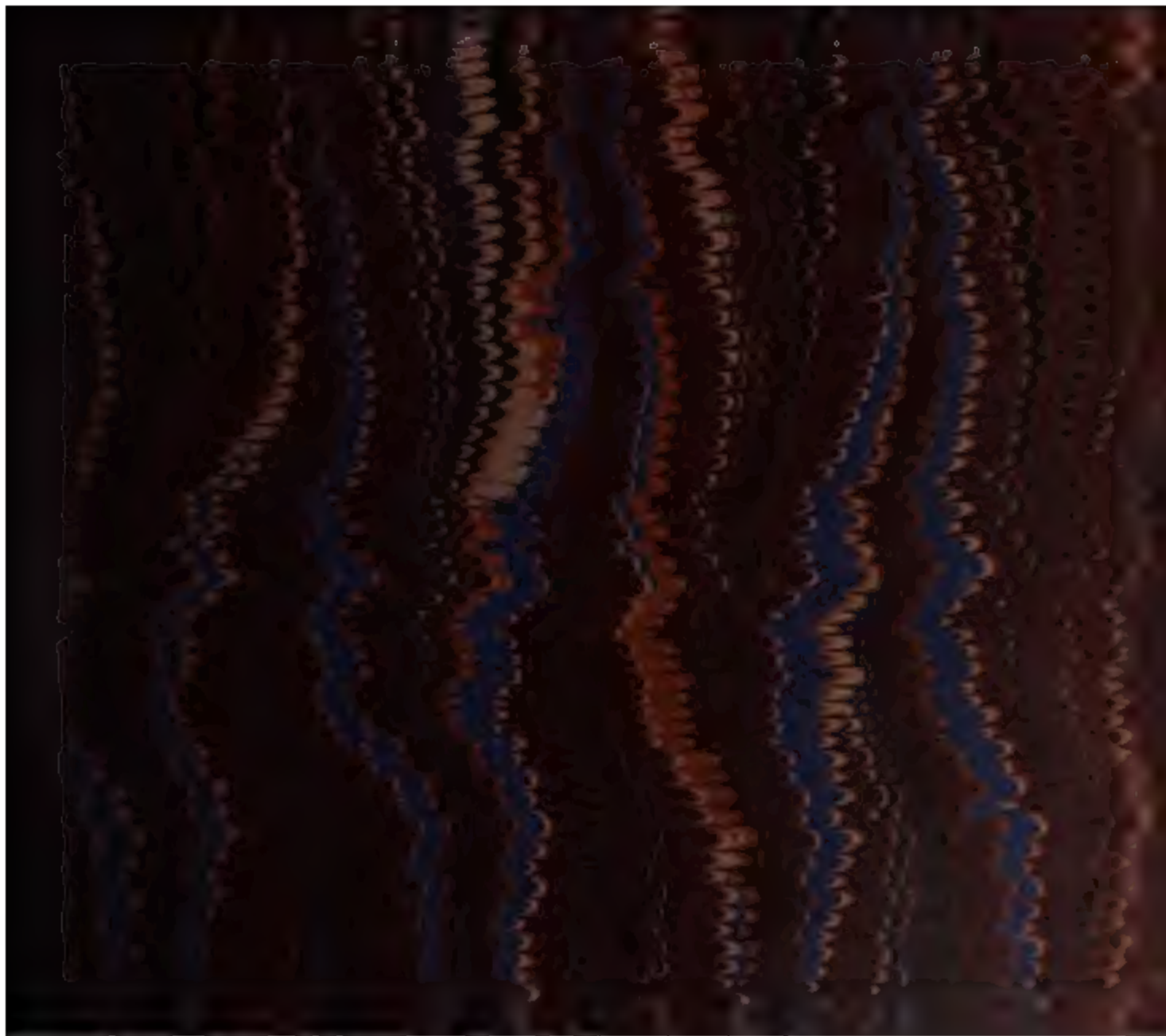
- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

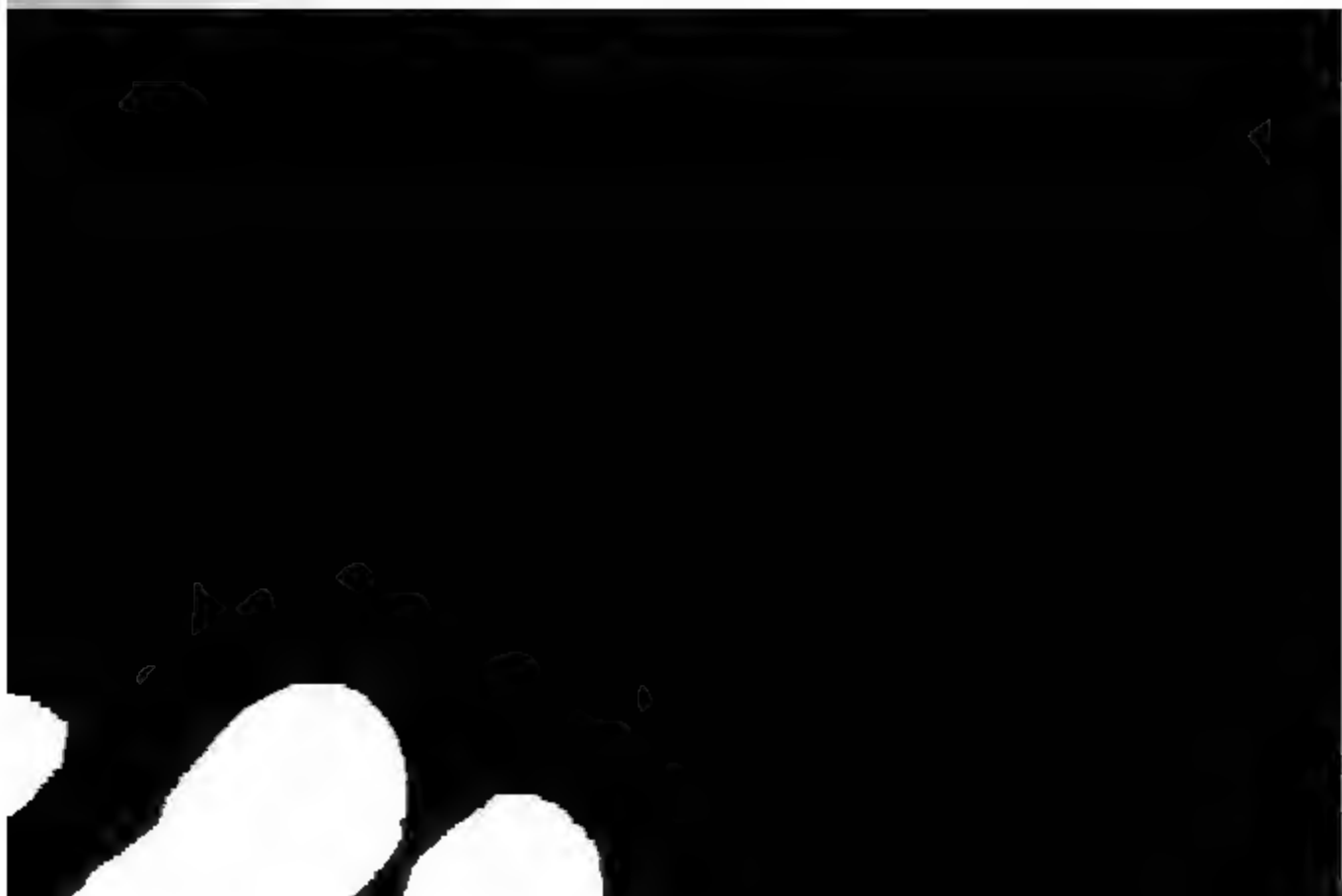
### About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>









  
**P R O C E E D I N G S**

**OF THE**

**ACADEMY OF NATURAL SCIENCES**

**OF**

**P H I L A D E L P H I A .**

---

**1869.**

---

**P H I L A D E L P H I A :  
PRINTED FOR THE ACADEMY.  
1869.**

•

、



9

don.

PROCEEDINGS

OF THE

ACADEMY OF NATURAL SCIENCES

OF

PHILADELPHIA.

---

1869.

---

PHILADELPHIA:  
PRINTED FOR THE ACADEMY.  
1869.

、  
.



PROCEEDINGS  
OF THE  
ACADEMY OF NATURAL SCIENCES  
OF  
PHILADELPHIA.

1869.

---

*Jan. 5th.*

The President, DR. HAYS, in the Chair.

Twenty-nine members present.

---

*Jan. 12th.*

The President, DR. HAYS, in the Chair.

Thirty-one members present.

---

*Jan. 19th.*

DR. BRIDGES in the Chair.

Thirty-three members present.

A committee having been appointed to draught resolutions with reference to the death of John Cassin, late Vice-President and Curator of the Academy, the following were offered and adopted:

The members of the Academy of Natural Sciences of Philadelphia having learned with great regret of the decease of their late Vice-President and Curator, JOHN CASSIN, do, in commemoration of the bereavement they have suffered, resolve,

1. That in the death of Mr. Cassin the Academy has lost a member and officer whose thoughts and acts were ever devoted to its interests and prosperity.

2. That in addition to the devotion thus manifested, they have been deprived of the counsel and exertions of one who was always ready to aid in every enterprise tending to the objects of the institution.

3. That in this unexpected termination of the scientific pursuits of their deceased associate, science has suffered a loss which cannot be repaired; the loss of one who, more than any other student of Natural History in America,  
1869.]

has advanced the science of Ornithology, and whose matured and well cultivated mind enabled him to render cheerfully and generously much assistance to younger students and to institutions of learning in that and other branches of knowledge.

4. That we deeply sympathize with the family of our respected colleague in this severe affliction.

5. That the Recording Secretary be directed to transmit a copy of these resolutions to the family of the deceased.

Jan. 26th.

DR. BRIDGES in the Chair.

Fifty-five members present.

Pursuant to the By-Laws, an election of members of the Standing Committees for the ensuing year was held, with the following result:

*ETHNOLOGY.*

J. AITKEN MEIGS,  
S. S. HALDEMAN,  
F. V. HAYDEN.

*HERPETOLOGY AND ICHTHYOLOGY.*

EDW. D. COPE,  
S. WEIR MITCHELL,  
THADDEUS NORRIS.

*ENTOMOLOGY AND CRUSTACEA.*

JOHN L. LeCONTE,  
GEO. H. HORN,  
TRYON REAKIET.

*GEOLOGY.*

ISAAC LEA,  
F. V. HAYDEN,  
T. A. CONRAD.

*COMP. ANAT. AND GEN. ZOOLOGY.*

JOS. LEIDY,  
HARRISON ALLEN,  
S. B. HOWELL.

*PHYSICS.*

ROBT. BRIDGES,  
R. E. ROGERS,  
JACOB ENNIS.

*ORNITHOLOGY.*

BERNARD A. HOOPES,  
W. P. TURNBULL,  
E. SHEPPARD.

*LIBRARY.*

JOS. LEIDY,  
J. L. LeCONTE,  
ROBT. BRIDGES.

*MAHMALOGY.*

HARRISON ALLEN

*BOTANY.*

ELIAS DURAND

was elected Curator, thus filling the vacancies caused by the death of Mr. Cassin.

The following gentlemen were elected members:

R. J. Levis, M. D., John J. Stevenson, Wm. M. Wilson, and Caleb S. Hallowell.

The following were elected correspondents:

Col. E. B. Carling, U. S. A.; Wm. Blackmore, of London.

*Feb. 9th.*

MR. JOS. JEANES in the Chair.

Twenty-two members present.

*Feb. 16th.*

DR. RUSCHENBERGER, Vice-President, in the Chair.

Thirty-four members present.

The following paper was presented for publication:

Note on Microscopic Crystals contained in some minerals. By Isaac Lea.

The death of Chas. N. Bancker was announced.

Professor Cope made some remarks on a new series of fossils, from the lime stone caves in the Southern States. He enumerated the species of extinct mammals, reptiles and fishes, discovered by him in the lime-stone breccia, which is the remnant of a cave in Wythe Co., Virginia.

He gave twenty species of mammalia, of which nine only could be demonstrated to be different from existing species. These were *Megalonyx Jeffersonii*, *Stereodectes tortus* Cope, *Dicotyles nasutus*, *Mixophagus spelaeus* Cope, gen. et sp. nov., *Sciurus panolius* Cope, sp. nov., *Tamias laevidens* Cope, sp. nov., *Tapirus haysii*, *Ursus amplidens*, *Hemiacis perdicida* Cope, sp. nov. *Stereodectes* was stated to be based on incisor teeth, which are more solid than in existing allied genera. Its pulp cavity is almost entirely closed throughout a large part of the length of the tooth. General character similar to those of the Marmot; size that of the porcupine.

[*Feb. 23d.*

The President, Dr. HAYS, in the Chair.

Thirty-six members present.

The report of the Biological and Microscopical Section was presented.

The following gentlemen were elected members: Wm. Dutty, Gen. Hector Tyndale, Charles Morris, Theodore Cuyler.

On favorable report of the Committee, the following paper was ordered to be published:

1869.]

## Notes on MICROSCOPIC CRYSTALS included in some Minerals.

BY ISAAC LEA.

During some years past I have given much attention to the examination of minerals under the microscope, and some of the observations were published in the Proceedings of the Academy in 1866.

About a year since, in the examination of a thin fractured piece of a large garnet from North Carolina, I was surprised to observe a number of very minute acicular crystals, which generally took two or three directions. This induced me to examine more closely into the varieties of garnets which were accessible to me, and supposing these crystals might have been observed by others, I referred to the principal works on mineralogy which have been published in France, Germany and in this country.

In none of these have I found any mention of these inclusions. But in that excellent work "Repertoire D'Optique Moderne," by M. l'Abbé Moigno, where he treats of optical mineralogy, I found that he states M. Babinet to have examined "star garnets" (*Granats asteriques*) some with four and some with six branches. He says that the star garnets with four branches are not very rare, —20 to 30 in 1000 to 1200—but that the star of six rays he found only one in 6000 specimens. Whether the filaments or fibers, as M. Babinet calls the asteroid reflections, are the same as the acicular crystals observed by me I cannot say, but certainly these latter are more common so far as my observation has extended, and I have observed no asterisms whatever.

In 154 specimens of Bohemian polished garnets, I found 48 with acicular crystals! This far exceeds the proportion stated by M. Babinet.

In the precious garnet from Green's Creek, Delaware Co., Penn., (uncut specimens), I found in the close examination of 310 specimens that 79 were possessed of acicular crystals, being nearly 26 per cent.—a very much larger percentage than mentioned by M. Babinet. Of the Brazilian *Pyrope* I examined 40 specimens. They were very pure and free from spots and cavities. I could not find a single acicular crystal in any one of them.

In *Essonite* I found no acicular crystals in the few specimens which I had it in my power to examine, nor in *grossularite*, *ovarovite*, *colophonite* or massive magnesium garnet.

*Cinnamon-stone* from Dixon's, near Wilmington, Del., was carefully examined in nearly 80 specimens, none of which showed any trace of acicular crystallization.

*Spinelle ruby*, of which I examined 28 specimens, produced no microscopic crystallized forms.

It will be difficult to ascertain what composes these microscopic crystals in garnets, but they may prove to be *rutile* when chemical analysis shall

On the Cetaceans of the Western Coast of North America. By C. M. Scammon. Edited by Edw. D. Cope.

Thomas Meehan presented some hickory nuts sent by Mr. W. H. Ravenel, of Aiken, South Carolina, supposed to be a hybrid between *Carya olivæformis* and *Carya aquatica*, because they were produced from trees raised from seed of the former which had trees of the latter growing near them; and because the fruit exhibited had the characters of both. Mr. Meehan said that there was a great difference of opinion amongst botanists whether the numerous forms of hickory nuts, so puzzling to botanists who attempted to classify them, were the result of hybridization, or were produced by the plant's own innate power of change by ordinary external circumstances acting on a supposed germ of form. Exact experiments were difficult, on account of the many years it would take to get at the results. He thought this instance furnished by Mr. Ravenel useful, as being one of the nearest he had known to an actual fact that hybridization has some influence on these varying forms.

Prof. Cope exhibited a specimen of the *Heloderma horridum*, of Wiegmann, from Tehuantepec, belonging to the Smithsonian Institution. He stated that the *Heloderma* of the Sonoran region proved, on comparison, to be a different species, differing in the more numerous scales on the head and body, in the shorter tail, and in coloration. He said it had been well figured by Baird in the Mexican boundary survey. He called it *H. suspectum*. He stated that though the lizards of this genus could not be proven to inflict a poisonous bite, yet that the salivary glands of the lower jaw were emptied by an efferent duct which issued at the basis of each tooth, and in such a way that the saliva would be conveyed into the wound by the deep groove of the crown.

---

March 16th.

The President, DR. HAYS, in the Chair.

Twenty-eight members present.

---

March 23d.

The President, DR. HAYS, in the Chair.

Twenty-nine members present.

The death of Jason L. Fenemore was announced.

---

March 30th.

The President, DR. HAYS, in the Chair.

Thirty-three members present.

The Report of the Biological and Microscopical Section was read. The following gentlemen were elected members:

Col. Jas. Greer, of Dayton, Ohio, Dr. Douglas R. Bannan, U. S. N., Geo. Henszey, John Birkinbine.

On favorable report of the Committee, the following paper was ordered to be published:

1869.]

## Third Contribution to the Fauna of the Miocene Period of the United States.

BY EDWARD D. COPE.

## PLATANISTIDÆ.

A more than usually complete skeleton of *Tretosphys grandævus* furnishes some characters, which, taken in connection with others known to exist in many others species of our Miocene dolphins, suggest that the true position of all of the latter is in or near the family above named.

In the skeleton mentioned there are preserved some twenty-four ribs, more or less completely, and the anterior segment of the sternum. No pieces can be referred as osseous hæmapophyses. The sternal piece also presents no pits for articulation with such hæmapophyses, either anteriorly or posteriorly, but rugose surfaces only. The probabilities are, therefore, that these elements were cartilaginous, a feature which Flower considers to be characteristic of the family Platanistidæ. The ribs present the same type. The *capitulum* and *tubercle* are well developed to near the posterior part of the vertebral column, where they become approximated, neither disappearing more than the other. In the *Physeteridæ* the *tuberculum* disappears posteriorly, while in the *Delphinidæ* the *capitulum* vanishes. In the *Platanistidæ* both remain and become united.

The cranium of *Lophocetus* exhibits features of the same family. The pterygoids are long, flat and extended anteriorly. The cavity which they roof is long and narrow, not short and inflated as in the *Delphinidæ*. The nasals and frontals are elongate as in *Pontoporia*.\* In another cranium of uncertain reference, but probably of the same type, these elements are rather more shortened.

The species referred to this family, which are so abundant in our miocene beds, appear, so far as known, to have the cervical vertebræ all distinct, and generally much more elongate than in any recent forms. This peculiarity has been observed in *Priscodelphinus a trop i a*, and *P. conradi*, in *Tretosphys grandævus*, as well as in several smaller species of the family. The only cervical vertebræ referable to those of *Ixacanthus cælospondylus* are less elongate, and nearly as thin as some of those of *Beluga canadensis*; the reference to that species is, however, quite uncertain. Of an even more attenuated form is the cervical of *Pontogeneus priscus* Leidy, a *Delphinoid* from the tertiary of Louisiana.

The teeth of *Tretosphys* are known, and these show some affinity to those of *Squalodon*, in the striate enamel surface, and anterior and posterior edge separating the inner and outer faces. The fang is cylindric, the crown regularly



## TRETOSPHERYS Cope.

Proc. Acad. N. Sci., Phila., 1868, p. 186, 190.

*Delphinapterus* "Lesson," Cope, Proc. A. N. Sci. Phila., 1868, 189.

The species of this genus I formerly referred to Lesson's genus as above, the Beluga of Gray, as one of the few genera of existing Delphinidæ, in which the cervical vertebræ are all similarly distinct. I could find no characteristic feature by which to separate the two. I am, however, now entirely able to separate the miocene from the recent species, in respect to generic structure. The new genus is defined as follows, so far as known:

Cervical vertebræ elongate as in the seals, and all distinct. Their di- and parapophyses all united and embracing a small foramen for the vertebral artery.

In the existing genus the cervical vertebræ are thin and disc like, and none but the anterior one or two embrace a foramen, and that rarely. In the genus *Tretosphys* the structure is quite similar to that seen among the seals, and has given the species a physiognomy quite distinct from the modern dolphins. They have evidently had a well marked neck, endowed with considerable flexibility. This constitutes an approach to the Zeuglodontæ, which is still more marked in the genus *Priscodelphinus*. In this also there is the same elongate series of cervical vertebræ, and well enclosed cervical canal.

The species of the genus may be defined briefly as follows:

I. But few and only posterior caudals with venous foramen at base of diapophysis.

a. Posterior lumbar three-sixteenths or less, longer than wide before diapophyses.

++ Neural canal with obtuse epapophysial ridge.

Articular surface with incised median impression, central rugulose disc, and broad circumference with raised concentric striæ; lumbar straight and strongly keeled below; caudals short and broad; large.....T. LACERTOSUS.

Articular surface without striæ, and with a deep punctiform median impression which is below the middle; most lumbar concave below; caudals more elongate, 35 lines long in young; smaller.....T. GRANDÆVUS.

Articular face without striæ, and with punctiform impression (on caudal); caudal stouter, 24 lines long in adult; smallest.....T. GABBII.

aa. Posterior lumbar  $\frac{1}{2}$  longer than width before diapophyses.

Articular face with punctiform impression, and no raised striæ; an epapophysis; caudal narrow, 39 lines long in adult.....T. URÆUS.

II. An anterior caudal with vascular foramen at base of diapophysis.

Articular face of lumbar with weak incised impression, smooth; below weakly keeled; length in adult 21 lines; the smallest species.

T. RUSCHENBERGERI.

The species which I described as *Delphinapterus tyrannus* (Proc. A. N. Sci. Phila., 1868, 189,) probably belongs to the toothless whales, and would correspond in size with the *Eschrichtius pusillus*. The collation of different parts of each of these species must be left for future opportunities. The vertebræ are distinguished by having the neural canal without epapophysis, the articular face with open median impression, and no striæ. The epiphysial ridges are much interrupted and slightly tuberculiform.

**TRETOSPHERYS LACERTOSUS**, *Delphinapterus (Tretosphys) lacertosus* and *D. hawkinsi* Cope, l. c. p. 190.

This species is known by portions of two individuals from Charles Co., Maryland, of one from the mouth of the Patuxent, and of five at least from the marl pits of John Hummel, Henry Ware and others, near Shiloh, Cumberland Co., N. J. Portions of crania with teeth, etc., are mingled with the vertebræ, and furnish material for a partial analysis of the characters of the species.

1869.]

**TETOSPHYS GRANDÆVUS** Cope. *Delphinapterus grandævus* Cope, Proc. A. N. S. 1868, 191. *Priscodelphinus grandævus* Leidy, l. c. 18, 51, 327.

The caudals of this dolphin were the parts of it first discovered. Since then a lumbar of one, and a large part of the skeleton of another individual have been received by the Academy, all being from the same locality, Shiloh, Cumberland Co., N. J. Unfortunately the last series contained no caudal vertebræ; its reference to this species is not entirely established, though the correctness of the same is very probable.

The remains of the most perfect individual consist of seven cervical, nine dorsal, and seven lumbar vertebræ; there are twenty-four ribs and the anterior element of the sternum. The distinctive features of the vertebræ have been already given. The manubrium of the sternum is T-shaped, and is somewhat expanded posteriorly. The anterior (inferior) face is plane, (slightly concave antero-posteriorly); the margins rounded. The superior face is roof-shaped to a median keel, which disappears posteriorly.

**TETOSPHYS GABBII**, *Delphinapterus gabbi* Cope, l. c. 191.

No material characteristic of this species has been found since its description.

**TETOSPHYS URÆUS** Cope, sp. nov.

This species is established on a lumbar vertebra from the miocene of Shiloh, Cumberland Co., N. J., with which I have associated a caudal vertebra from near the mouth of the Patuxent, which was lent me for determination by Philip P. Tyson, State Geologist of Maryland.

The character of elongation seen in the genus *Zarhachis* strikes the eye at once in this species. Although not carried so far as in that genus, it exceeds considerably species of this, or of *Priscodelphinus*, with which we are acquainted; hence, though the material is slight, there can be no doubt that it represents an animal not previously known.

The articular face of the lumbar is not complete in all its outlines, but has evidently been as deep as wide, and perhaps nearly round. The median impression is punctiform and remarkably strong. The profile of the inferior outline is concave and is constituted by an obtuse keel, on each side of which is a short longitudinal depression. The diapophyses have been broken off, but their bases are both broad and deep, slightly filling the concavity of the infero-lateral face. Supero-lateral face strongly concave in both directions.

	Lines.
Length of centrum.....	39
" " basis neurapophysis.....	28.5
" " basis diapophysis.....	20

**TETOSPHYS RUSCHENBERGERI**, *Delphinapterus ruschenbergeri* Cope, Proc. A. N. Sci., Phila., 1868, 189.

This is the smallest of the genus. It is known only from a caudal and lumbar vertebra of one individual, from Charles Co., Maryland.

**ZARHACHIS** Cope.

Proc. A. N. Sci. 1868, 189.

Examination of additional material renders it necessary to correct the characters of this genus as originally given. It was stated to differ from *Priscodelphinus* in that, while some caudals had spinous diapophyses, others possessed them flat, but imperforate. A vertebra supposed to indicate the latter characters I am now compelled to refer to another species and probably a genus. Other vertebræ assigned to *Z. flagellator*, must be referred elsewhere. A lumbar vertebra represents another species of probably the same genus, while a third has evidently pertained to still a third species. The genus will be characterized by the extraordinary length and slenderness of the lumbar vertebræ, and similar, though slightly abbreviated form of the caudals. The latter have spinous diapophyses, and in one species the former also. While the width of the articular faces of the centra of these vertebræ in the typical *Priscodelphinus* is but few lines less than the length, in the species of this genus the diameter of the same is only from four-sevenths to one half the length. The nearest approach is made by *Priscodelphinus stenus*, m., where this diameter is 6-7ths of the length.

The three species of *Zarhachis* may be distinguished as follows:

I. Median or anterior caudal with a strong longitudinal keel above the diapophysis—which is therefore probably present on the distal lumbars.

Epiphysis thicker, larger..... *Z. FLAGELLATOR*.

II. No longitudinal keel on lumbars. Diapophyses broad, flat; epiphyses thin: large..... *Z. TYSONII*.

Diapophyses narrow, subspinous; epiphyses thin; small..... *Z. VELOX*.

**ZARHACHIS FLAGELLATOR** Cope, Proceed. Acad. Nat. Sci., Phil., 1868, 189, pars.

The caudal vertebra, described as above, is the only indication which we have as yet of this large adolphin.

Miocene, Charles Co., Md.

**ZARHACHIS TYSONII** Cope, sp. nov.

This species is established on one posterior lumbar vertebra only, but its form is so characteristic as to render its identification a comparatively simple matter. The attenuated form characteristic of the genus is accompanied by broad diapophyses, showing that, as in *Priscodelphinus*, the species differ in the number of the posterior vertebræ which exhibit the contraction of the diapophyses.

The specimen preserved belonged to an adult animal. It was apparently one of the most posterior lumbar, as there are two feeble longitudinal ridges beneath, whose interval is again obtusely ridged and perforate by several foramina. The inferior outline is strongly concave in longitudinal section, and all the planes are concave in transverse section. The articular faces are a little wider than deep. The neurapophyses occupy a base of .75 the length of the centrum. The diapophyses are about equidistant between them and the nearest inferior ridge.

	Lines.
Total length centrum.....	48
Transverse diameter articular face.....	29
Vertical " " ".....	27
Width neural canal (internal).....	5
" between inferior ridges.....	8

This specimen was found at the miocene beds at the mouth of the Patuxent River, Maryland. It is water worn, and has been probably washed from the cliffs, and been covered by the tide.

1869.]

The animal to which it belonged was not less attenuated in the posterior part of the vertebral column than the great *Basilosaurus*.

**ZARHACHIS VELOX** Cope.

This species is likewise only represented by a single vertebra, which is from the lumbar series anterior to the position of that of *Z. TYSONII* just described. It has pertained to an adult animal of half the size of the preceding, and one which carried the narrowed subspinous diapophyses forward, though perhaps not so markedly as the *Priscodelphinus spinosus*, m.

The inferior outline is straight, and is the edge of a very strong thin keel, whose greater median prominence is due to the strong concavity of the inferior surfaces. The same concavity with that of the upper surface causes the existence of a strong longitudinal lateral keel, from the middle of which springs the diapophysis. The basis of the neural arch is thin and does not extend over more than  $\frac{1}{6}$  the length of the centrum.

The articular faces are discoid, and if one diameter exceed another it is the vertical; they have a somewhat expanded appearance from the concavity of the sides. Surfaces smooth.

	Lines.
Length centrum.....	33
Transverse diameter of extremity..	17
Vertical " ".....	17
Internal width of neural canal .....	3.1
Length of basis of diapophysis.....	8

This species was taken from the miocene marl from the pits of Reuben Ayers, near Shiloh, Cumberland Co., N. Jersey.

It indicates an even more slender and snake-like cetacean than the preceding, of much smaller size.

**ESCHRICHTIUS** Gray.

There is in the Thomas collection a portion of the cranium of a small *Balænoïd*, which from its resemblance to those of the existing finner whales, its small size, locality, and black color, I attribute provisionally to the *Eschrichtius pusillus*. It serves to confirm the affinities expressed in the name established on the ramus of the mandible. The alisphenoids present a deep, smooth posterior excavation, as in *Sibbaldius*, while the infero-lateral processes of the basioccipital are stronger than in that genus. The concha of the periotic bones are preserved; they are characterized by the possession of a hooked process turned outward, on the outer and more elevated margin.

An examination of additional material of these extinct *Balænidæ*, has



Upper edge broad behind only, and these bearing only the *inner* series of foramina. Elsewhere with a median ridge and rows of foramina below on each side; much decurved; less convex externally. Medium... *E. EXPANSUS*.

Upper edge nowhere broad, and with a deep or shallow groove below it on inside; less decurved, less convex externally; small..... *E. PSILLUS*.

*ESCHRICHTIUS LEPTOCENTRUS* Cope, Proceed. Ac. N. Sci., Phil., 1867, 147.

The largest of the miocene species, the vertebræ considerably exceeding corresponding ones of the *E. cephalus*.

*ESCHRICHTIUS CEPHALUS* Cope, loc. cit. p. 148.

Indicated by a large part of the cranium and other parts of the skeleton, with flipper, etc., from Charles Co., Md., and by a portion of the mandible of a second individual from near the mouth of the Patuxent River, Md.

*ESCHRICHTIUS PRISCUS* Leidy. *Balæna prisca* Leidy, Pr. A. N. S. Phil., 1851, 303. *Balænoptera prisca* Cope, l. c. 1867, 144.

A portion of a mandibular ramus of this species furnishes all that we know of it. In size it is intermediate between the two here preceding and following it.

The miocene of Westmorland Co., Va.

*ESCHRICHTIUS EXPANSUS* Cope. *Megaptera expansa* Cope, l. c., 1868, 193.

In addition to numerous vertebræ, portions of the limbs and of three mandibular rami of two individuals have been discovered. The latter present, for a marked distance on the proximal portion, a flat plane on the upper face, instead of the usual angulate ridge, which is equally distinct from the outer and inner faces. In *E. priscus* the superior plane is only a continuation of the outer convex face, and accordingly the external series of nutritious foramina extends along it. The plane is occupied on the other hand, in the *E. expansus*, by the inner series.

The inferior margin is a rather obtuse angle; the general form is not compressed, nor much convex externally, as in *E. priscus*.

	Inches.
Depth ramus.....	2.75
Thickness " .....	1.65
Foramina (internal) two in.....	2.50

From the mouth of the Patuxent, coll. of P. T. Tyson, State Geological Survey of Maryland.

*ESCHRICHTIUS PSILLUS* Cope, Proceed. Acad. Nat. Sciences, Philada., 1868, 159. 191.

A ramus of the mandible of this species from the mouth of the Patuxent River differs from the type in having the inner groove of the superior margin much less marked; the inner face is plane, but leaves the superior groove with a marked convexity. The outer face is gently convex, and the outer foramina open externally. Slightly decurved, as well as curved longitudinally. Behind the foramina, the superior margin rises to a well marked base for a coronoid process, which is not preserved.

	Inches.	Lines.
Depth ramus ..	1	10.5
Thickness. ....	1	2.5
Foramina (internal) intervals.....	1.	

## CROCODILIA.

### THECACHAMPSA Cope.

Further investigation shows that this genus is gavial-like, and that the peculiarity which characterizes its dentition also belongs to *Plerodon* Meyer of the European Miocene. *Thoracosaurus*, of the American Cretaceous, presents also the same character. *Plerodon* differs from the American form in 1869.]

being like *Crocodylus* in cranial characters, while *Thecachamps* is a gavial. The species of the latter are *T. sericodon* Cope, abundant in New Jersey, at Shiloh and elsewhere, with long curved cylindric teeth. *T. sicaria* Cope, from Maryland, with much compressed crown of the tooth, with prominent cutting edges. *T. antiqua* (*Crocodylus* Leidy,) with teeth less curved, cylindric and with very short cutting ridges. From Virginia.

The characters of the three species may be thus compared:

The crowns of the teeth not compressed, with short cutting edges.

*T. antiqua*.

Crowns cylindric, curved, with long and delicate cutting edges.

*T. sericodon*.

Crowns compressed with very prominent crenulate cutting edges, on a marginal base.....*T. sicaria*.

The last named also possesses a large maxillary tooth, near the position of the ninth of *Crocodylus*, which fits a corresponding concavity between two of the mandibular teeth, resembling in this the existing genus *Tomistoma*.

### TESTUDINATA.

#### TRIONYX Geoff.

*TRIONYX LIMA* Cope, sp. nov.

Represented by one costal-bone from Shiloh, N. Jersey. It is massive, and strongly sculptured by numerous approximated narrow raised ridges, which extend across the bone, with little inosculation, and which leave intervals between them a little wider than themselves.

The characters may be compared with those of the three species from the cretaceous of New Jersey, as follows.

Costal bone transversely figured by narrow elevated ridges..... *T. lima*.

Costal bone with thick, low, transverse ridges, which are connected by cross-ribs which leave series of pits..... *T. priscus*.

Costal bones with transverse irregular grooves proximally which remain along the sutures only distally, leaving an area of a shallow honey-comb pattern medially..... *T. pennatus*.

Costal bones with a shallow coarse honey-comb pattern, tending to confluence distally ..... *T. halophilus*.

April 6th.

The President, DR. HAYS, in the Chair.



*April 21st.*

DR. BRIDGES in the Chair.

Fifteen members present.

Mr. Redfield called the attention of the meeting to the following Memoranda attached to specimens of *Schizæa pusilla*, in the Herbarium of N. Y. Lyceum of Nat. Hist.

"First discovered by Dr. C. W. Eddy, near Quaker Bridge, in the pine barrens of New Jersey, about 30 miles from Philadelphia. Dr. E. was in company with J. LeConte, Pursh and C. Whitlow, and though he and Mr. LeConte found all the specimens, Pursh has claimed the honor of the discovery himself."

Signed,

TORREY AND COOPER.

1868.

Above is in handwriting of Dr. Torrey.

"First found in 1805; not found again till detected by me in company with Dr. Torrey, in June, 1818."

Signed,

COOPER.

*April 27th.*

The President, DR. HAYS, in the Chair.

Twenty-three members present.

The issue of the sixth number of the Proceedings for 1868 was announced.

The following gentlemen were elected members:

Isaac S. Fogg, John C. Sinclair, Rev. J. L. Withrow and Henry Bower.

The following were elected correspondents:

Albany Hancock, of New-Castle-upon-Tyne, England; and Brevet-Major F. Curtis, M. D.

On favorable report of the Committees the following papers were ordered to be published:

**On the CETACEANS of the Western Coast of North America.**

BY C. M. SCAMMON, UNITED STATES MARINE.

Edited by EDWARD D. COPE.

*Introductory note by the Editor.*

The present article, by Capt. Scammon, is the result of many years' observation in an almost unexplored and with difficulty explorable department of zoology. It was submitted by the author to the Smithsonian Institution, with the request that it might be rendered beneficial to science. The Secretary, Prof. Henry, referred it to the editor, with a request to publish such parts as should be deemed valuable to zoology, and to add such elucidation and explanation as would contribute to the same end.

In the carrying out of these views of the Secretary of the Smithsonian Institution, a general classification has been made, and a systematic record of the species and genera mentioned in the essay has been prefixed. A few species have been inserted from other sources, and the opportunity improved to give descriptions of some species from the Atlantic coasts.

1869.]

The scientific student will await with interest the receipt by our national institution of further materials, so that the structure and affinities of these remarkable beings may be fully made known.

# PART I.

## SYSTEMATIC SYNOPSIS

*Of the species of the Cetaceans of the West Coast of North America. By Prof. E. D. COPE, Corresponding Secretary of the Academy of Natural Sciences of Philadelphia.*

### CETACEA.

Two sub-orders of this order are known to exist at the present period, which differ as follows :

#### MYSTICETI.

Mandibular rami distinct from each other, without symphysis. Teeth none in either jaw. A series of transverse corneous laminae on each side of the roof of the mouth.

#### DENTICETI.

Mandibular rami united distally by a symphysis. Teeth present in one or both jaws. No corneous laminae in the mouth.

#### I. MYSTICETE.

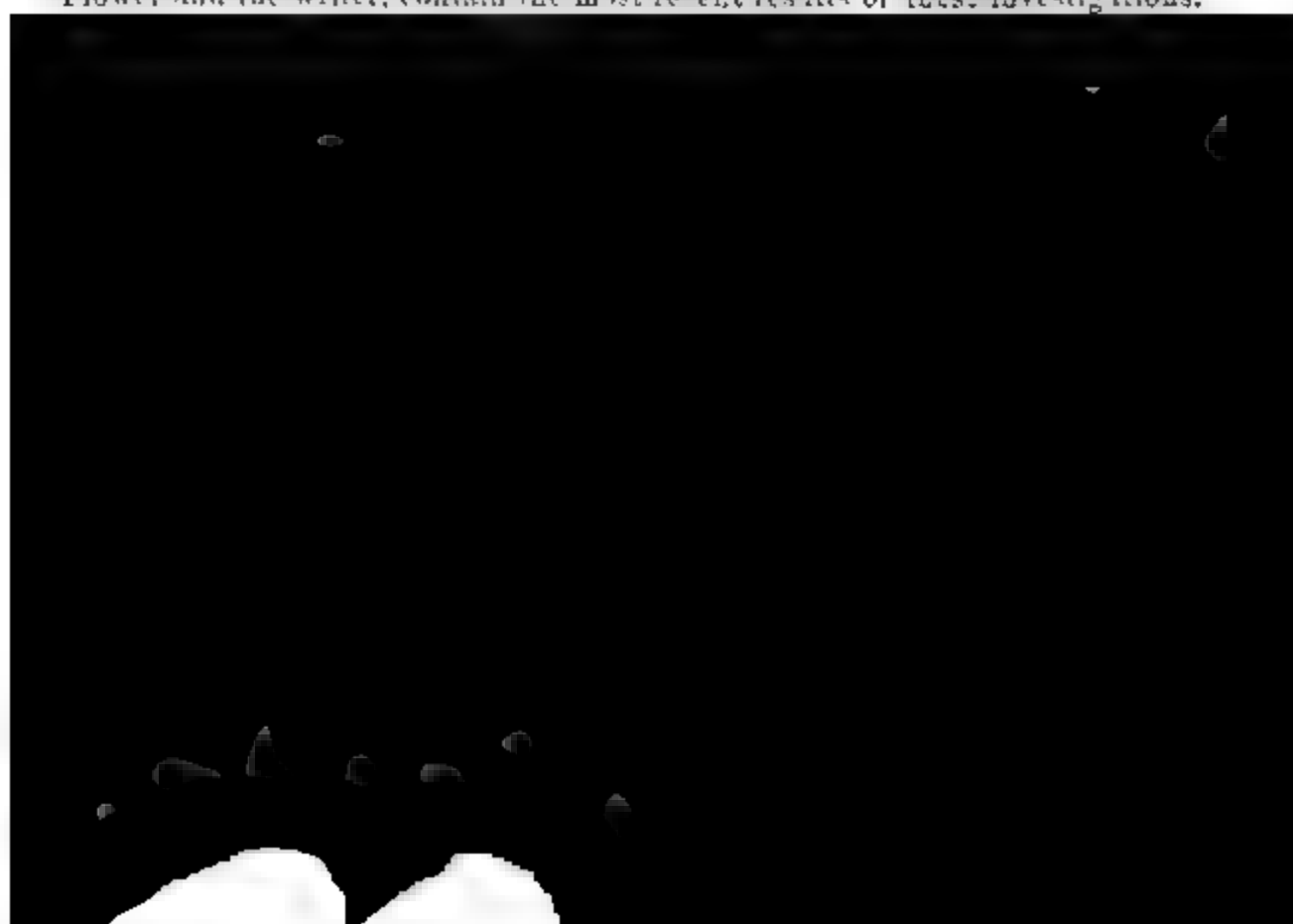
There is but one family of this group, characterized as follows :

Spiracles two. Front of cranium plane, much raised above the orbital processes ; no transverse or longitudinal crest on the cranium..... *Balaenidae*.

#### I. BALÆNIDÆ.

Of this family numerous genera and species have been discovered and described. It embraces the most gigantic of vertebrated animals, and some of the most useful. They inhabit all oceans, but are rarer in the equatorial regions, abounding most in the frigid and temperate seas. Their pursuit gives occupation to many men of all nations.

Owing to their vast bulk and the want of appreciation on the part of those who are engaged in their capture, their study has been one of great difficulty. It is only within a few years that a sufficiently extended amount of material has been accumulated to enable the genera and species to be properly discriminated. The works of Gray, Eschricht, Reinhardt, Lilljeborg, Van Beneden, Flower and the writer, contain the most recent results of these investigations.



Anterior ribs single headed.....*Balænoptera*.  
 Anterior ribs double headed.....*Sibbaldius*.

Those engaged in the pursuit of whales recognize these natural groups without difficulty, as evidenced by their vernacular names of long standing. Thus the species of div. I are "right whales," of II A, "scrag whales;" of II B a, "humpback whales;" and the *Balænopteras*, etc., "finner whales." The last are most numerously represented by species.

#### BALÆNA Linn.

Two species of this genus have been described by authors as inhabiting the North Pacific Ocean, though the materials upon which their identification has been based is of the most slender description. I am as yet unable to determine to which of them the right whale mentioned by Capt. Scammon should be referred. I therefore enumerate both here. A third species, the Bow Head of American whalers, is stated to pass south of Behring's Straits at certain seasons of the year, according to Capt. Scammon. I enumerate it as the same as the Greenland Right Whale of English authors, which is the "bow-head" of the Eastern American whalers, in contradistinction to the Right whale, (*B. cisarctica*).

#### BALÆNA MYSTICETUS Linn.

Bow-head. Catal. Whales and Seals, Brit. Mus. p. 81.

#### BALÆNA SIEBOLDII Gray.

Cat. B. M. 96, *Balæna australis* Temm. Faun. Japon. t. 28, 29, (from Japanese model).

#### BALÆNA CULLAMACH Chamisso.

Nova Acta, Acad. Curs. xii, 251 Tab. (from Aleutian model). Cope, Pr. A. N. Sci. Phil. 1868, 225.

#### RHACHIANECTES Cope.

This genus is now first characterized. Its only known species I originally united with *Agaphelus* Cope, but the form of the scapula is so different that it must be distinguished. While that of *Agaphelus* is identical with that of *Balænoptera*, it is in the present genus quite like that of *Balæna*.

#### RHACHIANECTES GLAUCUS Cope.

*Agaphelus glaucus* Cope, Proceed. Academy Nat. Sciences, Philada. 1868, p. 225. The California Gray Whale.

This species was originally described from specimens by Wm. H. Dall, of San Francisco.

#### MEGAPTERA Gray.

In this genus the rudiment of a dorsal fin exists as a hump on the posterior part of the dorsal region. The fins are longer than in any other genus, and two or more of the cervical vertebræ are occasionally more or less coössified. The following species are known more or less imperfectly: *M. longimana* Rudolphi, from the Arctic Seas; *M. oshyia* Cope, from the Western Atlantic; *M. brasiliensis* Gray, (*Balænoptera* Gray), from the coast of Brazil; *M. lalandii* Fischer, from the Cape of Good Hope; *M. kuzira* Gray, from the Western Pacific. The full measurements and description of Capt. Scammon enable me to add another species, viz.:

#### MEGAPTERA VERSABILIS Cope.

Spec. nov. The North Pacific hump-back.

This species possesses pectoral fins, apparently intermediate in length between those of the *M. longimana* and the species with shorter fins, as *M.* 1869.]

osphyia and *M. kuzira*. They are between one-third and one-fourth the length; in the two last mentioned, between one-fourth and one-fifth. It has 26 pectoral and gular folds. Siebold states that the *M. kuzira* possesses but ten. In this animal the warts extend to the top of the front, a character not ascribed to any Atlantic Megaptera. It differs also from *M. longimana*, and resembles *M. lalandii* and *M. kuzira*, in having the pectoral black on the external face; in the Greenland species and in the model of the Aleutian Islanders, described by Chamisso, it is white. The characteristic color of the belly, in the most typical form, is said to be entirely black. In this respect it differs from all other Megapteræ, which present more or less white or grey, on the inferior surfaces at least.

#### BALÆNOPTERA Lacep.

Many species of this genus inhabit the immense area of the ocean. They are regarded as pertaining to two genera by Gray. Thus the known species fall into two groups, viz.: I, those in which the dorsal fin is at the commencement of the third fourth of the length from the head; and II, those where this fin measures only the second third. To the first belong certainly only *B. rostrata* and *B. velifera*; to the second *B. physalus*, *B. duguidi* and *B. sibbaldii* Gray (*Cuvierius* Gray), all Atlantic. There is not enough known of the following species to determine their characters in this respect: *B. arctica* Schlegel, N. West Pacific; *B. swinhoei* Gray, China Seas; *B. patachonica* Gray, S. W. Atlantic; *B. antarctica* Gray, New Zealand Sea. The following species have been named: *B. fasciata* (Physalus Gr.), *B. australis* Desmoul. The species of the North West coast of North America is sufficiently described and figured by Capt. Scammon to furnish means of comparison with most these species. It differs from these, and may be called

#### BALÆNOPTERA VELIFERA Cops.

The Finner Whale of the Oregon coasts.

This species differs from all that have been described in that respect, in the color of the baleen; from the *B. arctica* of the Japanese Seas, the coloration of the body separates it; in the latter the sides are spotted black and white, in the present shaded from the brown of the upper to the white of the lower surfaces. The large size of the dorsal fin and its anterior position are marked characters; the northern species, with larger fin, is still more different from the *B. arctica*, the only one with which it would be probably identical.

The more southern form, with very small fin, may be another species—possibly a *Sibbaldius*. The *B. velifera* cannot unfortunately be compared with



the length from the muzzle; dorsal line behind it smooth. *S. tectirostris* Cope, *S. laticeps* Gray. II, the dorsal a small conical mass, situated well posteriorly; the dorsal line with several humps behind it; several cervicals with complete cervical canal; *S. tuberosus* Cope. III, the dorsal fin a small conic mass situated three-fourths the length from the muzzle, the dorsal line smooth behind it; the axis only, with complete cervical canal; (*Flowerius* Lillj.) *S. borealis* Fisch.

The *S. TUBEROSUS* m. differs from the *S. laticeps* as above, and probably in its five or six humps above the caudal portion of its vertebral column. The latter peculiarity is not mentioned in authors' descriptions of *S. laticeps*, and though its existence is not denied, it is probably wanting. I have heretofore considered this whale as the latter species, and described it as such.—*Proceed. Acad. Nat. Sci. Phila.* 1866, 297.

The finner whale, above mentioned as *SIBBALDIUS TECTIROSTRIS* Cope, is established on a nearly complete specimen of a young ♀ in the Museum of the Academy. Its length when fresh, in a nearly straight line from the end of the muzzle to the emargination of the flukes, is between 47 and 48 feet. This depends on independent observations of several persons. The skeleton as preserved lacks a number of caudal vertebræ\* and a few dorsals. Restoring those that are at present wanting, from the obvious extent of interruption, and the last caudals, according to Flower's estimates for the *S. laticeps*, we have the following total length:

	No.	Length. ft. in.	Restored. ft. in.
Cervicals.....	7	2 6	0 0
Dorsals.....	11		2 0
Lumbosacrals.....	16		0 0
Caudals—diapophyses perforate.....	4	28 10	0 0
“ —diapophyses imperforate .....	10		1 0
“ —no diapophyses.....	1	3	0 6
Cranium.....		10 0	
		<hr/> 41 7	<hr/> 3 6
Restored.....		3 6	
Total .....		<hr/> 45 7	

The individual is in the young stage, since not only are all the epiphyses of the vertebræ separated, but those of the humerus also. According to Flower, the coössification of the epiphysis of the humerus takes place when the animal has developed somewhat beyond one-half the adult dimensions. This animal may therefore be considered as being at least half grown, which renders a length of 70—80 feet probable for the adult. The present specimen was a female, according to those who had seen it in the flesh, and who described to me the mammæ and the vulva. In its larger dimensions it thus exceeds the *B. laticeps*, and especially the *B. tuberosus*, as the latter is adult at about the size of this young specimen.

The atlas has not yet reached the Museum. The axis presents below no surface adapted to a *tuberculum atlantis*. The median portion of the anterior face of the centrum presents a low conic projection, the *processus odontoides*. The di- and parapophyses are united distally, embracing a large ring, whose outside longitudinal diameter is two-thirds the transverse diameter of the centrum of the same. The neural arch presents no spine, but a pair of lateral prominences like rudimental zygapophyses. The parapophyses of the remaining cervicals are long, except on the seventh, where they are almost wanting. The diapophyses are long in all, longest and decurved on the seventh, where it

\* All are in possession of the Academy, but those alluded to are yet in a compost heap and unfit to handle.

stands above the parapophysis of the sixth. They are nearly united with the parapophysis on the third cervical, and are no doubt fully so in mature age. The fourth cervical is lost, but it is scarcely probable that it presented a complete ring for the transmissal of the vertebral artery, etc. There are no rings attached to the vertebrae from the fifth inclusive. The centra are all transversely oval.

	Inches.
Height centrum and arch of axis.....	12.25
" centrum.....	7.1
Transverse extent of axis.....	25.
" " centrum of do.....	11.5
" " neural canal.....	5.75
" " of third cervical.....	23.
" " centrum do.....	11.
Length parapophysis sixth cervical.....	5.
Vertical diameter centrum (? 5th) dorsal.....	7.
Length centrum do.....	6.
Vertical diameter centrum second caudal, with perforate diapophyses...	10.5
Length centrum do... ..	10.5
Height spine and arch middle lumbosacral.....	14.5
" from floor canal to top anterior zygapophysis do.....	6.

There is no neural spine on the second, third and fourth cervicals, and it is rudimental and small on each of the remainder. Those of the dorsals and lumbar are not particularly elevated.

The humerus is very short and thick, and the hand remarkably small.

The scapula, as in other *Sibbaldii*, has considerable antero-posterior extent, and well developed acromion and coracoid. The disk is divided into three areas on the inside, by two slight ridges.

#### *Dimensions.*

	Inches.
Antero-posterior width.....	33.
Vertical " .....	21.
Length acromion.....	7.5
" coracoid.....	4.5
Diameter of glenoid cavity.....	6.

The muzzle is elongate, and with a narrow acumination. The supraorbital plates of the frontal are

Each nasal is as wide as long medially; anteriorly concave above, the line of junction of the two in one plane, forming a median ridge, which is prolonged into a prominent median point. The orbitals are slightly compressed and

carved outwards, and acuminate. There is a distinct angular process below the condyle.

Measurements.

	Ft.	In.
Length of cranium (axial).....	10	6.
Greatest width of occipitals.....	3	7.
Width at supraorbital plate.....	4	4.
“ of each maxillary at middle.....		9.75
“ of supraorbitals above orbit.....		13.
“ (least) of frontal region.....		13.5
“ of nasals.....		4.3
“ intermaxillaries at middle .....		5.3
Length nasal.....		6.
“ malar .....		“
“ maxillary above.....	7	6.
“ ramus mandibuli (in curve) .....	10	
“ “ “ to coronoid. ....		19.
Depth “ “ at condyle.....		8.5
“ “ “ at coronoid.....		13.
“ “ “ at middle.....		9.
Length otic bulla.....		5.2

The baleen is short, and of a dark lead color, the inner and shorter margin white for varying widths. The bristles are fine for the size of the animal, and not nearly so coarse as in *Megaptera o s p h y i a* or *Rhachianectes g l a u c u s*.

Length of longest plates with gum.....	In.
Width at base .....	15
No. plates in four inches .....	10
Whole number plates on one side, 126 preserved—add about 24 lost from extremity.....	150

Most of the ribs are yet in process of cleaning, and will be introduced into the final monography and illustration of the North American Cetacea in course of preparation. That which by its deeply bifurcate head indicates the generic affinities of the species, is in form much like the first of *S. l a t i c e p s*. It measures in

	Ft.	In.
Total length.....	3	
Distal width.....		7.25

The anterior head is the narrower, and its line of junction with the posterior extends to near the middle of the length of the same.

The animal's color above was a uniform black ; the exterior face of the flippers and stripes along the gular plicæ were also black. The belly was white, separated, according to my informant, from the black abruptly, forming a “water line.” The posterior face of the flippers white for the distal half. The under side of the caudal fluke white also. These points I derived from Joshua Carey, who stripped the carcass.

The dorsal fin was not seen by me, but was described by a number of parties, whose statements agreed. It was of the usual form and elevation common among finner whales, compressed, with a long base, and eighteen inches in height ; the dorsal line behind it clean and smooth.

The species appears to be most nearly allied to the *S. l a t i c e p s* of Gray, of the Arctic Seas. It differs distinctly in the following points: 1. The nasal bones of the latter are longer, more parallelogrammic, and not strongly keeled and mucronate. 2. The coronoid process of the mandible is less elevated. 3d. The cervical vertebræ, including the axis, are furnished with well developed spinous processes. 4. The mandibular ramus is more compressed. 5. The vomer is more, and (6) the pterygoids are less prolonged posteriorly.

The difference from the *S. t u b e r o s u s* is found in the form of the dorsal  
1869.]

fin and character of the dorsal line; it is marked, and of a kind which Lilljeborg has regarded as generic in the case of *S. gigas* (*S. borealis*), but which appears to me to be specific in this case. This species is distinctly smaller than the *S. tectirostris*, and presents a *tuberculum atlanticum* articulating with the *epistrophæus* below, which is not indicated by the latter in *S. tectirostris*.

In many respects the species appear to be quite similar. The deposit of the specimen of *S. tuberosus* in the Museum of the Academy having been delayed, the nearer comparison must be made when it arrives, which will be in a short time, it is anticipated.

As compared with the *S. gigas* there is a marked difference in the form of the nasal bones, if Dubar is to be relied on; he represents them as even more elongate than in the *S. laticeps*. The first rib of this animal is apparently much wider. The annulate cervicals are less numerous. The dorsal fin has a different form and position.

The type of the *S. tectirostris* came ashore during the winter of the present year, on the coast near Sinepuxent Bay, on the Maryland peninsula. It had been dead some time; the stomach contained but little, and that a mixture of finely divided scaly and stringy material, not readily recognizable. Bottles dropped at numerous points off the coast of Maryland and Virginia by the Coast Survey, were always carried ashore in the course of a few days or weeks, to the south-west of the point where dropped. It is therefore probable that this whale is a native of the ocean from which it drifted, and that it is one of the "fin-backs" of the Western Atlantic.

The species described by Capt. Scammon, if of this genus, belongs to the sub-group of the *S. borealis*, so far as the proportions and position of the dorsal fin are concerned; the cervical vertebrae are not yet known. Its size would also distinguish it from the species of the other groups, as well as from the *S. schlegelii* Flower, from the Malaysian Seas.

#### *SIBBALDIUS SULFUREUS* Cope.

##### The Sulphur-Bottom of the North West Coast.

This immense whale is as yet too insufficiently known to be distinguished as fully as desirable, but the marked peculiarity of coloration separates it from the only species with which a comparison is necessary—the *S. borealis* or *gigas* of the North Atlantic. Capt. Scammon describes it to be a gray or brown above, paler than in the *Balenoptera relifera*, and beneath, a sulphur yellow. Length from seventy to ninety feet. The colors of the *S. borealis* are described as polished black above, milky white beneath, by Dubar.

DEATHS.



*DELPHINIDÆ.*

This family is most numerously represented by species in the order. The genera are also numerous. Those represented in the ocean bordering North America are the following:

## I. The phalanges numerous.

Pectoral fins, long narrow, on the lower part of the sides; cervical vertebræ consolidated; the teeth few, obtuse; dorsal fin ..... *Globiocephalus*.

## II. The phalanges not more than 4—5 in the same digit.

α. Two or more cervical vertebræ consolidated.

β. Teeth cylindric.

γ. Beak of skull short, broad; teeth few, large; a dorsal fin.

Teeth early deciduous ..... *Grampus*.

Teeth permanent, acute..... *Orca*.

δ. Beak of skull elongate, exceeding brain case; teeth small, numerous.

Dorsal fin present; teeth long, more or less acute..... *Delphinus*.

Dorsal fin none; teeth as last ..... *Delphinapterus*.

Dorsal fin ? teeth short, obtusely rounded..... *Sagmatias*.

ββ. Teeth compressed, spade-shaped.

Dorsal fin present..... *Phocæna*.

Dorsal fin none ..... *Neomeris*.

αα. Cervical vertebræ all distinct.

β. No dorsal fin.

Teeth little deciduous; incisors normal..... *Beluga*.

Teeth deciduous, except one incisor, which is prolonged into a tusk.

*Monodon*.

*GLOBIOCEPHALUS* Gray.

The "black-fish" of whalers are included in this genus; the species represent it in all seas as yet known. They differ less in remote regions than the species of some other genera do. The species of the eastern coasts of North America appears to be the same as that found on the coasts of Europe, the *G. melas*. The species of the Pacific coasts is fortunately so fully described by Capt. Scammon, that it can be distinguished very readily from those heretofore recorded.

*GLOBIOCEPHALUS SCAMMONII* Cope.

For details of character of this abundant species I refer to Capt. Scammon's description, and only contrast it here with the species to which it is allied. It pertains to the section of the genus characterized by the absence of white band or other mark on the abdomen, and is among these one of the most uniformly black species. Its more numerous teeth  $\frac{10-12}{8-10}$  distinguish it from *G. machrorhynchus* of the South Seas. In Gray's Catalogue three species remain for comparison, the *G. chinensis*, which probably does not belong to the genus; the *G. sieboldii*, which, not being described, cannot be regarded as valid; and *G. indicus* Blyth. The measurements of the latter indicate a much wider pectoral fin, a longer and lower dorsal fin, and considerably wider flukes. The measurements given by Blyth are as follows:

	Ft.	In.
Total length.....	14	2
Width flippers.....	2	6
Length dorsal.....	2	6
Depth ".....		11
Extent of flukes.....	3	

It inhabits the Bay of Bengal.

The present species is named in honor of Capt. Scammon, who has furnished us with a mass of information on the subject of the Marine Mammalia, and an amount of novelty in connection with it seldom equalled in the history of zoology.

1869.]

## ORCA Gray.

The species of this genus are the wolves of the ocean, and occur in all seas, swimming in small companies, and living by violence and plunder.

Two species of the genus are described briefly by Capt. Scammon, which differ from each other much as the two Atlantic species do, in respect to the form of the dorsal fin. In one in each case the fin is exceedingly high and erect, in the other broader, more oblique and less elevated.

## ORCA RECTIPINNA Cope.

The dorsal fin extremely elevated—"six feet or more in the larger males," whose length "averages 25 feet" at right angles to the axis of the body, and one-third the length from the end of the muzzle. Muzzle slightly acuminate. Color black, more or less white below ("most in females") with white lines on the sides from the eye sometimes to the hinder margin of the dorsal fin. ? No large white spot behind eye. This species appears to be distributed from California southwards.

## ORCA ATER Cope.

The dorsal fin much shorter, wider, and more obliquely directed. Black, with a large white spot behind the eye. Muzzle ? not acuminate. ? A brown dorsal crescent behind fin.

The North West coasts from Oregon to the Alentian Islands.

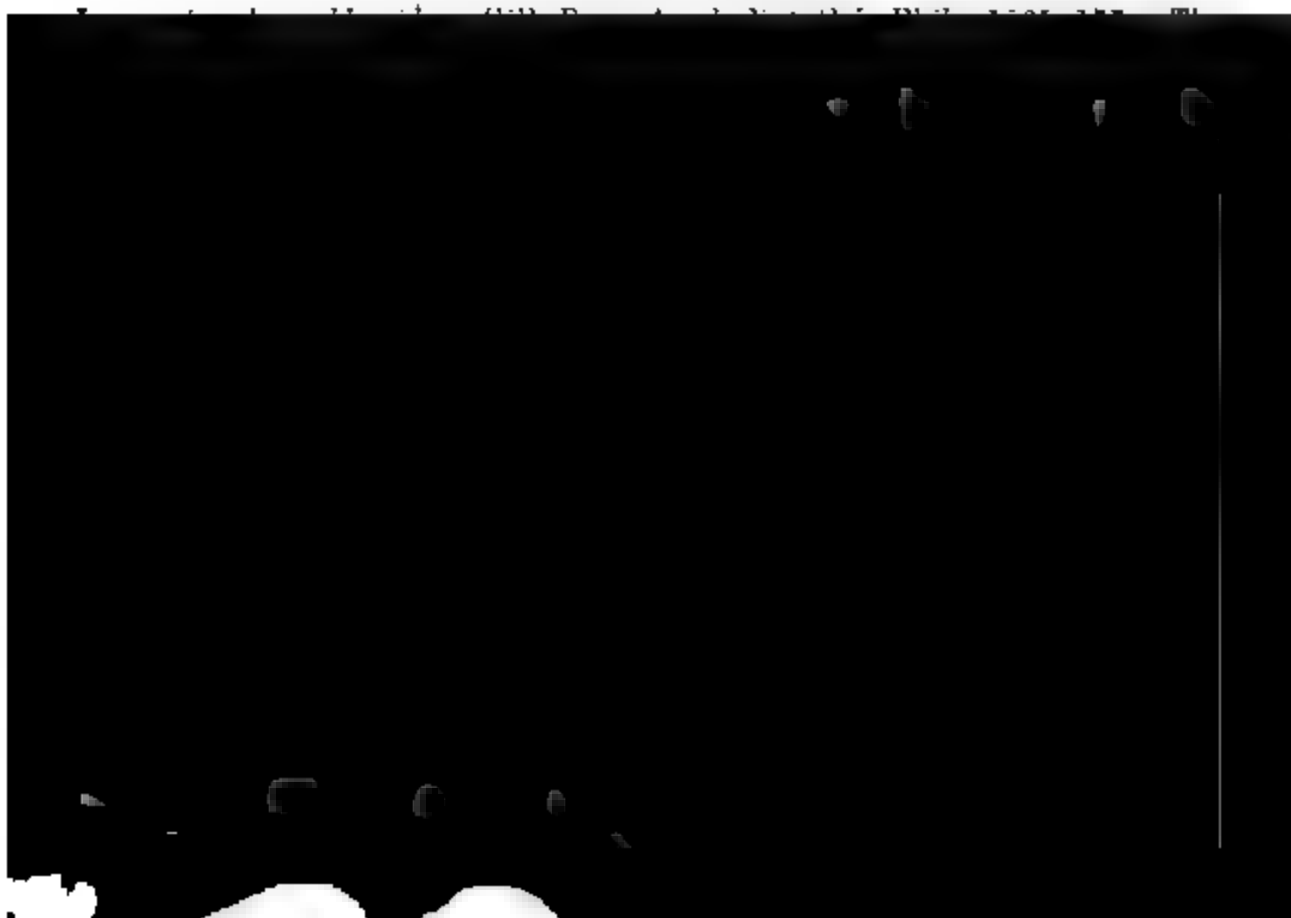
The species of this genus from the Atlantic Ocean, whose colors are known, reverse the arrangement existing in the Pacific species. According to Lilljeborg, the *O. gladiator* has the straight elevated fin, and the large white spot on the side, while the *O. eschrichtii*, which has the less elevated and oblique fin, does not present this peculiar mark. In both these animals the belly is white, as is also the case with *O. eschrichtii*. In *O. ater* the inferior surfaces appear to be entirely black, or nearly so.

It will no doubt be found to be the case with both these Orcas that their females will have less elevated dorsal fins than the males. This is known to be the case with the Atlantic species, as described by Eschricht and Reinhardt.

## DELPHINUS.

Many species of true dolphins have been described as inhabiting the Pacific Ocean, by French and American travellers. Those enumerated by Capt. Scammon are not sufficiently described to be identified. They are probably the following:

## DELPHINUS OBLIQUIDENS Gill.



PHOCÆNA Cuvier.

PHOCÆNA VOMERINA Gill.

Proc. Acad. Nat. Sci. Phila. 1865, 178.

This well defined species is the Bay Porpoise of the present essay.

BELUGA Lacep.

Capt. Scammon has not given any definite characters by which the species of this genus occurring in Northern Pacific waters may be distinguished. I take, however, the present opportunity to make public descriptions of two species of this genus from the Arctic Seas. They have been already described by me, but rather briefly. First is the BELUGA RHINODON Cope, Proc. Ac. Nat. Sci. Phil., 1865, 278.

The cranium is peculiar for the breadth and shortness of the muzzle and its sudden contraction; the fewness of the teeth; the large extent of the vomer produced behind the palatines; and the long proportion of the maxillaries in front of the nares uncovered by the intermaxillaries.

The length of the muzzle to the notch equals the distance from the latter point to the crest at the inner extremity of the os parietale; its breadth at the same point is about three-fourths the length and less than the width of the cranium at the orbits. The prenasal exposed portion of the maxillaries is parallelogrammic, the length about two and a half times the width, and extends very nearly to a line connecting the fundus of the maxillary notches. The maxillaries present no other carinæ than a short one on each side the o. o. nasalia.

The premaxillaries terminate opposite the posterior extremity of the vomer, and are deeply grooved for the outlines of the "triangle," which terminates with the basal third of the muzzle. They are one-third wider than the maxillaries (from a vertical view) at the middle of the muzzle, where the contraction is strongest, and form with them an arch of nearly 180° width at the internal foramen three-fifths width from outer margin to notch of maxillary.

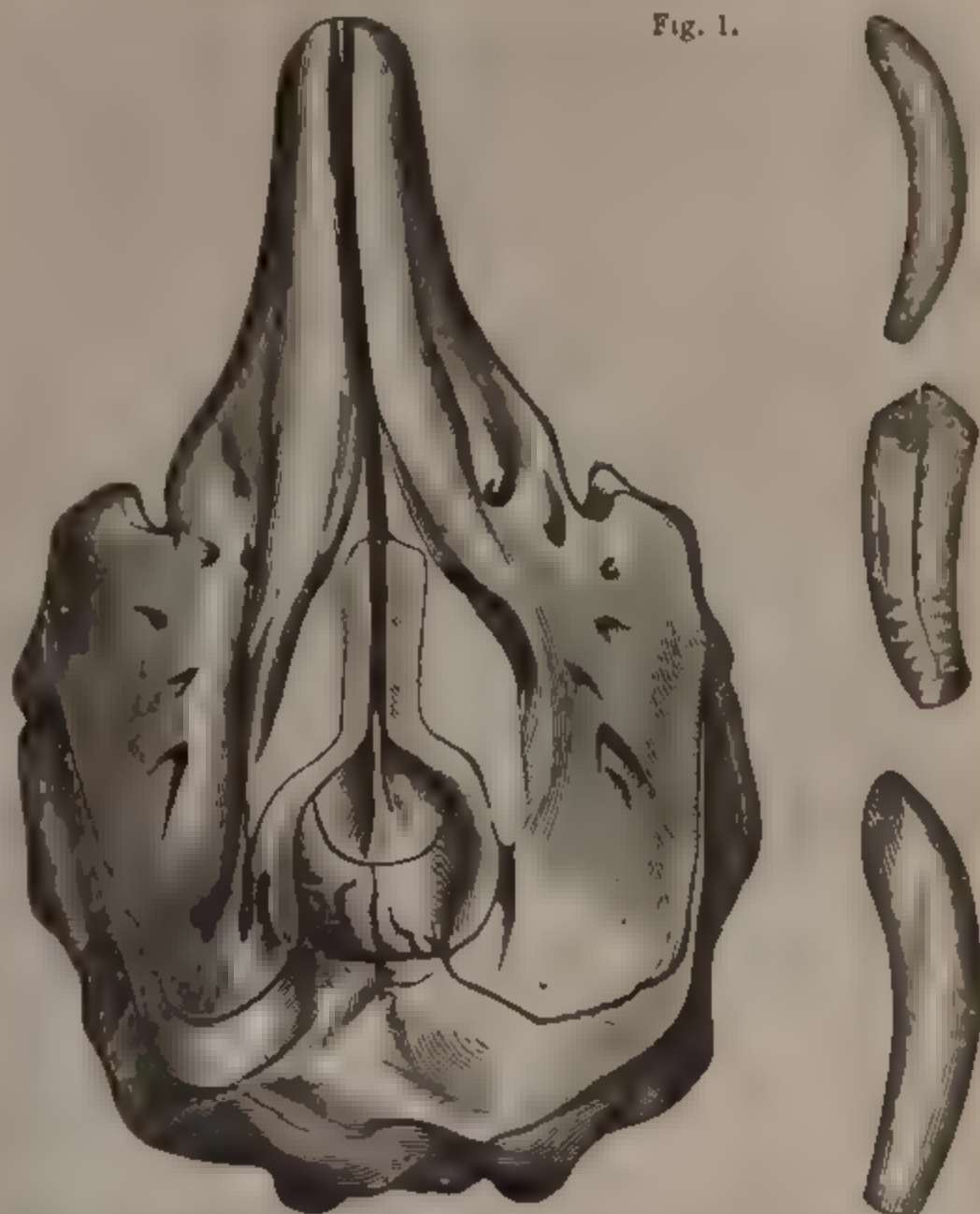
The median portion of the palatines is narrowed, and with an inner angle just prevent the contact of the maxillaries and vomer. The outer wing is also narrow, and impressed externally with a broad groove; it extends as far as opposite the squamosal process. The latter bone is not in contact with the postorbital process, and presents a large internal lamina, which overlaps without touching the alisphenoid. Posterior upper vomer plate with the deep corner emarginations seen in Phocæna.

Posterior temporal crest not developed; exoccipitals flat, slightly concave externally. Supraoccipital with two large fontanelles and above the foramen two impressions for insertion of muscles. Line to the weak spine straight, Crest not developed; frontal band broad, flat; knob above nasals slight.

	In.	Lin.
Length from end of muzzle to concavity of occ. condyle. ....	16	0·8
“ “ “ occipital spine ..... ..	14	8·8
“ “ “ nares..... ..	9	10
“ “ “ maxillary notch..... ..	7	7·5
“ of temporal fossa ..... ..	5	1
“ of orbit..... ..	1	11·4
“ of ramus mandibuli..... ..	12	
“ of gonys..... ..	1	9·5
Breadth at distal 2-5ths of muzzle..... ..	2	5
“ at notch ..... ..	5	6
“ at orbits... ..	8	11·4
“ at frontal margins..... ..	8	6·8
“ of foramen magnum..... ..	2	2·5
“ of paroccipital alæ..... ..	7	2·8
“ of external nares..... ..	2	2·2
Teeth ..... ..	$\frac{4}{8}$	

1869.]

Fig. 1.



Behind the alveoli of the *U. maxillare* is an indication of a groove, as though a full series of teeth had existed in early life, and been shed and the alveoli obliterated by deposit of bone. This appearance is, however, deceptive, as the teeth in these animals are not developed from deep seated capsules, but more superficially, perhaps a few very weak teeth were supported by the integument posteriorly. In *B. leclivis*, where the posterior teeth are mainly so held in position the alveoli are very distinct.

In the teeth of the *B. rhinodon* certain specific characters may be noticed, though the animal is much smaller than the *B. leclivis*, the teeth are quite as large and as much worn. The median or vertical mandibulars, instead of a conic or curved crown terminate in a broad, rounded, slightly elevated summit; the form of these teeth is clavate. A pair of the oblique mandibulars have a similar form.

	Ln.	Lin.
Cervical vertebrae ... ..	7	4½
Dorsal vertebrae ... ..	10	17
Lumbar (imperfurate) ... ..	12	30½
Caudal (perforate by lateral foramen) ... ..	6	11½
Caudal from first wanting neural spine ... ..	11	14½
With cranium ... ..		16

Total..... 7 ft. 10½ in

[April,

The atlas is characterized by the nearly equal width of the portion of the neural canal above and below the constriction, the narrowness of the wing outside the articulating surfaces, and the elongation of the latter. The inferior apophysial articular surface is broad, rounded, and separated by a high ridge from the anterior face of the inferior limb. The inferior lateral process is opposite the middle of the articulating surface; it is short, obtuse; the superior is small, acute.

Width of canal above constriction....	2	2.6
“ “ below “ .....	2	2.6
“ wing from posterior articular surface.....		6
Vertical diameter of posterior articular surface.....	2	3

The body of the axis is short, and the lateral alæ longer and thinner than in the *angustata*, though not extending so far beyond the articular facets. The inferior articular surface is longer than broad and occupies two-thirds the surface of the body. The neural spine is short, flat, and terminates obtusely, over the penultimate cervical. The zygápopophysial articulation marks three-fifths the distance between the external alar angle and the tip of the neural spine.

	In.	Lin.
Total transverse diameter.....	6	10.2
“ of centrum.....	2	4.
Heighth of neural canal.....	1	8.2
Length of neural spine.....	2	1.2

Of the remaining cervical vertebræ, the third is distinct, and has very short lateral processes, the superior longer, originating with the neurapophysis from a very broad base. Its neural arch is completed above by a loose suture. The superior lateral process diminishes and is reduced to nothing on the fifth, appears higher up on the sixth, and commencing at the zygapophysis on the seventh is very elongate and much recurved, its extremity being opposite the articulation of the fourth or fifth. The inferior lateral process increases to the fifth, where they are nearly cylindrical, three-quarters inch long by a half broad, and directed downwards at an angle of 45°. These processes rapidly diminish and are reduced to nothing on the seventh vertebra.

Dimensions of seventh cervical vertebra :

	In.	Lin.
Length of body.....		7.4
Transverse diameter of same.....	2	6.2
“ “ of neural canal.....	2	7.8
“ extent of diapophysis from canal.....	1	10.8
Height of neural canal.....	1	7.4

The dorsal, as well as the other vertebræ, are distinguishable from those of the other species by their great breadth as compared with their length. The costal articular surfaces of the centra are not distinct.

Dimensions of the third dorsal :

	In.		In.
Length of body.....	1 $\frac{3}{8}$	Span of neural arch.....	2 $\frac{1}{4}$
Anterior vertical diameter....	1 4-8	Width “ “ .....	
Anterior height of canal.....	2 1-8	Heighth neural spine (from be-	
Breadth canal at diapophysis	2 6-8	hind).....	$\frac{3}{4}$

The lumbar vertebræ possess longer diapophyses than those of the *angustata* and *concreta*, which are also less dilated distally on the anterior margin. That of the first is nearly truncate.

Its dimensions are :

	In.		In.
Length body.....	2 3-16	Same to posterior extremity..	3 $\frac{1}{2}$
Anterior transverse diameter.	2 $\frac{1}{8}$	Floor of canal to zygapophy-	
Height canal (anteriorly).....	1 15-16	sis.....	2 1-16
Width at diapophyses.....	1 $\frac{3}{4}$	Zygap. to apex of neural	
Epiphysis to anter. extremity		spine.....	2 7-16
of diapophysis.....	2 15-16		

1869.]

The fifth or typical lumbar offers the following proportions:

	In.		In.
Length of body.....	2 7-16	Breadth diapophysis distally	1 13-16
Anterior breadth.....	2 1/2	Height of canal.....	1 1/2
Length of diapophysis.....	4 1/2	Zygapophysis to apex neural spine .....	2 1/2

The series of caudals diminishes gradually in size to the last.

The dimensions of the fourth (perforated) are :

	In.
Length body.....	1 3-16
Transverse anterior diameter.....	2 1/2
Neural arch and spine.....	1 1/2

The neural canal is laterally compressed, or oval. The articulating ridges of the epiphyses and corresponding vertebral bodies are fewer, coarser, and more elevated in this species than in the *angustata*. In the latter they are more delicate, and have a less number of complete radii.

There are ten pairs of ribs as in the *catodon*, one pair less than in the *concreta*. The first is destitute of the anteriorly curved angular process of the *catodon*, but the tubercle is on an elevated base. The sixth, seventh and eighth ribs are flat on the posterior face; the last three are without neck and head, and this portion of the seventh is much less than the same of the sixth; in the seventh also the angle is furthest from the tubercle. The anterior ribs are not so dilated at the extremities as in the *angustata*.

	In.	Lin.
First rib; head to angle.....	3	5
" " angle to extremity.....	5	1
Seventh rib; length.....	17	10
" " ".....	12	6

The stylohyal of the specimen of this species is of relatively the same size as that of the *angustata*, but is flatter, less narrowed at its anterior extremity, not swollen on its posterior border, nor constricted at its posterior extremity. Its hinder border is somewhat rugose. The body and posterior hyoid cornua are much like those of the *angustata* and *declivis* and *coossified*.

	In.	Lin.
Length of body.....	2	1
" " stylohyal.....	4	1
Expanse of posterior cornua.....	6	6

The sternal pieces are separate. The anterior has been found like that in the *angustata*, with equally strong lateral vertical processes. The hæmaphyses are relatively shorter than in *concreta*; the fourth wants the produced thin anterior margin of the third, and is about the same length as the

A skeleton of this species in the Museum of the Academy of Natural Sciences was brought by Dr. Isaac I. Hayes, from Upernavik, Greenland, in lat. 74°.

I was at first disposed to regard this as a young individual of one of the species under observation, perhaps of *B. angustata* or *declivis*. A very brief study was sufficient, however, to reveal its manifold differences from these. In cranial features it resembles most the *B. declivis*, but I am satisfied that no such difference in the form of the muzzle of the cranium as obtains here can exist between young and adult of the same species.

*BELUGA DECLIVIS* Cope, Proc. Acad., Phila., 1865, 278.

This species resembles the *angustata* in the general proportions of the cranium; the muzzle is relatively shorter in the specimen, and its margins decurved toward the end; it therefore resembles also the *catodon*, which has much less marked maxillary notches, a different prenasal space and shorter, heavier mandible. The inferior view presents some analogy with that of the *B. rhinodon*, in the largely developed vomerine tablet; but the palatines are even further separated by an interval of three-quarters of an inch. The horizontal palatal surface of these bones mark a narrow incurved longitudinal process only, and they appear in the inferior half of the anterior wall of the nasal meatus, as narrow strips lying next to the vomer. The pterygoids are nearly exactly parallelogrammic, their exterior angles alone in contact on the horizontal plane. The exposure of the premaxillaries extends, as in the other species, to beyond opposite the fifth maxillary tooth. Of the superior portion of the palatines the anterior portion extends to opposite the notch; the vertical portion of the posterior ala is broader than the horizontal. The middle of the palate is prominent without lateral angulation. The proportions are explained by the following measurements.

	In.	Lin.
Length from end of muzzle to convexity of condyle.....	22	
“ “ “ “ occipital crest.....	21	5
“ “ “ “ nares.....	15	3
“ “ “ “ maxillary notch.....	10	7
“ “ foramen magnum to occipital crest.....	4	5
“ of temporal fossa.....	7	
“ “ orbit.....	2	8
“ “ ramus mandibuli.....	16	7
“ “ gonys.....	2	9
Breadth at distal two-fifths muzzle.....	3	6
“ “ notch of maxillary.....	7	7
“ “ orbits.....	11	6
“ “ frontal margins.....		
“ of foramen magnum.. ...	2	
“ “ external nares.....	2	9
“ between apices of paroccipital crests.....	9	
Teeth.....		10 9

The sella turcica is little marked, and the suture between the sphenoid and presphenoid distinct, as indicated in the figure in Huxley's Elem. Compar. Anat. 277. The teeth are relatively much smaller than in the *concreta*, and the posterior but loosely attached to the alveolæ, being principally held in position by the palatal integument. The anterior above are considerably worn on their inner faces.

The tympanic and periotic elements are much like those of the *rhinodon*, and though the latter is known from a much smaller animal, its tympanic bone is about the size of that of the former. The only noticeable difference is the greater elevation of the proötic.

The corresponding portions of the *Beluga angustata* are larger and considerably heavier, though the cranium is a little less in all dimensions than that of the *declivis*. The opisthotic process is more prolonged than in the 1869.]

others, and the region around the foramen for the seventh pair is very rugose and gives rise to a process behind the foramen. The probic is acuminate anteriorly, and ends in an acute process. The inner lip of the tympanic is much elevated at its anterior extremity, causing the profile of this extreme of the bulla to be truncate instead of acuminate; the Eustachian sinus is thus shorter and broader. Of the longitudinal lobes of the inferior surface of the bulla, the interior is weaker and the external more prominent and narrower than in the declivis. The anterior end of the inferior view is broader, more oblique, and more truncate than in the other species.

	<i>angustata.</i>	<i>declivis.</i>	<i>rhinodon.</i>	<i>Steno frontatus.*</i>
Length of tympanic bulla 1 in.	11 l.	1 10	1 9.5	1 7.5
" " other elements 2	3.5	1 11.5	1 10	1 4.5
Total depth	2	1 8	1 7.5	1 3

*General Measurements.*

	No.	In.	Lin.
Cervical vertebrae.....	7	7	3
Dorsal ".....	11	28	7
Lumbar (to 1st chevron bone).....	10	40	
Caudal (imperforate).....	1	3	7
Caudal (perforate).....	18	31	9
Caudal (from first wanting neural spine) .....(11)			
With cranium.....		22	
Total 11 ft. 1 in. 2 l.		138	2

The cervical vertebrae are in general similar to those of *B. angustata*; they present the same acute infero-posterior process of the atlas, short truncate inferior lateral processes and longer but weak superior lateral. As in it the last is longest and recurved to opposite the sixth. There is nowhere a vertebral foramen. They differ from those of the *angustata* in the heavier proportions of the atlas and axis, and the high compressed carinate neural spine of the latter. The axis is also peculiar in that the inferior (circular) surface of articulation with the atlas process occupies a median position of the inferior face, and is separated by a deep groove from an anterior transverse articular surface, which belongs to an apparently decurved odontoid process. The latter fits a corresponding and separate surface just behind the margin of the spinal canal of the atlas.

Width of spinal canal above.....	2	8.5
" " " below.....	1	8
Transverse diameter of atlas ..	7	10.5
Vertical " " " ".....	1	1

tally, anteriorly, as in angustata and concreta. The diapophysis of the first is obliquely truncate, and furnishes a ligamentous attachment to the angle of the last rib.

Its dimensions are :

	In.	Lin.		In.	Lin.
Length body.....	3	6	Same to posterior extremity....	5	10
Anterior transverse diameter...	2	10	Floor canal to zygapophysis....	2	9
Height of canal.....	2	1	Zygapophysis to apex of neu-		
Width do. at diapophyses..	1	10	ral spine.....	4	1
Epiphysis to anter. extrem. of do	4	7			

Of the caudals, the last five are transverse.  
The dimensions of the fourth perforated are as follows :

	In.	Lin.
Length of centrum.....	2	9
Transverse anterior diameter.....	3	4
Neural arch and spine.....	1	10
Hæmal arch and (very low) spine (from centrum) .....	1	7
“ “ length .....	1	10
Diapophysis projection.....		8

The neural canal is compressed.  
The radiating ridges of the epiphysial articulations on all the vertebræ are very coarse and much broken up into mammillæ.  
The coössified body and lesser cornua of the os hyoides do not resemble those of the angustata as much as the latter do those of the rhinodon. The body is not so long as its greatest breadth, and the surface articulating with the cornua the shortest of all. Viewed from below, the posterior area is one-half the anterior (equal in angustata) has a heavy double posterior margin, and is marked by a median process. The cornua are of nearly equal width throughout, and not expanded on the margins. Their proximal extremities would have a trigonal section, owing to their inferior thickened angle.

	In.	Lin.
Length body.....	3	1
Breadth “ .....	3	7
Length of cornu .....	3	7
Expanse of cornua.....	8	9

There are eleven ribs, of which the three posterior have no head, and the first articulates by head with the seventh cervical vertebræ. The first, like that of B. angustata, has the tubercle on a backward curved process. The superior half of the shank of this rib is thin and expanded on its outer margin, while on the lower half it is obliquely flattened. The ribs from the second to the fifth are considerably dilated distally ; the posterior aspects of sixth, seventh and eighth are rounded.

	In.	Lin.
First rib ; head to base of angular process.....	1	10
“ length of “ “ .....		8
“ base of process to dist. extremity .....	7	10
Seventh rib ; length.....	24	5
Last “ “ .....	16	10

Seven pairs of ribs are attached to bony hæmapophyses, of which five pairs articulate immediately with the sternum. The first is smooth, flat, and dilated distally ; the second narrower and thickened distally ; the third is dilated and sharp edged on the middle of the anterior border. The penultimate has a slight curvature, and the last is cylindrical and very slender. The sternum is yet distinguished into three principal pieces, the last narrowest and longitudinally divided. The articular cavities are at the sutures except the two anterior, which are close together at the front of the anterior piece. The latter has a cordate anterior outline, no cornua, and a convex posterior suture.

## Dimensions :

			In.	Lin.
Length of first hæmapophysis.....			5	
" fifth "			8	3
" last "			7	3
" anterior sternal segment.....			6	4
" median "			3	5
" posterior "			3	7
Breadth of anterior "			6	7



Fig. 2.

One of the chief peculiarities of this species, and that from which it derives its name, is seen in the scapula. On placing the glenoid cavity in the same plane with that of the scapula of the *angustata*, the acromion is observed to be in the general plane of the scapula, and not deflected inward, and to be shorter and much decurved. The coracoid is also decurved so as to be nearly parallel with the acromion; the extremities of the two are connected by a strong ligament. This direction of the coracoid is the opposite of what is seen in most other Delphinidæ, and all others of this genus, where it is recurved and acuminate.

The superior sinus, while more deeply incised than that of the *angustata*, is much more open, having divergent, instead of parallel outlines.

	In.	Lin.
Greatest length of scapula.....	12	10
Glenoid cavity to anterior angle.....	7	9
End of coracoid " " .....	5	

The deltoid process of the humerus is as wide as the condyle. Olecranon distinct. There are two large carpals opposite the inferior digits, and three smaller of the outer row, opposite the second, fourth and fifth respectively. The three inferior digits are more closely approximated in the fluke than the two superior. Phalanges (counting from above), 3—4—5—4—3; fourth digit longer than second.

	In.	Lin.
Length humerus.....	5	1
" ulna and radius.....	4	2
" carpus and third digit .....	7	7
Breadth at carpus.....	4	7

The only specimen of this species at my disposal is not fully adult, as the vertebral and humeral epiphyses are not yet anchylosed. It was brought by Dr. Elisha K. Kane, on his return from the arctic regions, from what precise locality is not stated. He presented it to the Museum of Comparative Zoology, Cambridge, Mass., whence it was kindly lent me by Dr. Alexander Agassiz, to whom my acknowledgements are due.

### PHYSETERIDÆ.

#### HYPERAODON Lacep.

No species of this genus from the Pacific Coasts is mentioned by Scammon, but the present is embraced as an opportunity of alluding to the species of the Eastern coasts of North America.

In the Proceedings of the Academy 1865, p. 280, I characterized briefly a whale of this genus under the name of *H. semijunctus*, which is represented by a specimen in the Museum of the College of Charleston, So. Ca. The characters furnished are meager, and it was anticipated that opportunity would soon have occurred to amplify them. This has been, however, disappointed, but is still looked forward to.

Two years ago two individuals of this genus entered the harbor of Newport, R. I., and after a lively chase one of them was captured. It measured twenty-seven feet in length. Its bones were preserved, and some of them, including the cranium, have been sent to the Academy of Natural Sciences, through the attention of its member, Saml. Powell, of Newport. He has also sent numerous photographs of its carcass, taken just after its capture, from various points.

These render it evident that the species is quite distinct from that described by European authors as *H. rostratus* (or *H. bidens*). Its most striking feature is the relatively longer and more slender beak, and less elevated and prominent front. This is obvious on comparison with the figures of Hunter, of Deslongchamps (Mem. Soc. Normandie) of Gray, (Zool. Erebus and Terror) and of F. Cuvier (Cetacea) and constitutes a material distinction. Thus, in the Newport specimen, it is one-twelfth of the length, or 2½ feet; equal three-fourths the distance between the eye and the spout hole. In a Cape Cod specimen 1869.]

it measures twenty-two inches in a length of twenty-four feet. The prominent swollen front is in the Newport whale, considerably compressed, and the eye is placed in a strong longitudinal prominence on each side of the head.

The dorsal fin, as in Deslongchamps's specimen, is small, and posterior. The caudal fluke is not emarginate. The color is dark, deeper above than below. It remains a question whether this is the *H. semijunctus*. The principal character on which that species rests is the non-coössification of the posterior four cervical vertebræ, a very remarkable character, and one which leads to the question of its pertinence to the genus. The cervical vertebræ of the Newport specimen are entirely coössified. The same character is furnished by a second specimen.

This is the skeleton preserved in the Museum Compar. Zoology at Cambridge, Mass., of an individual cast ashore during the winter of the present year, at Dennis, near Cape Cod, Massachusetts. It was stripped of its blubber by Perez Hall, of that place, who kindly sent me a sketch of it. He stated its length to be twenty-four feet, of which the muzzle measured twenty-two inches: the expanse of the flukes was six feet. The stomach was filled with the beaks of cuttle fish. On inquiry of J. A. Allen, of Cambridge, well known as a naturalist there, I learn that the cervical vertebræ of the animal are solidly coössified, as in the *H. rostratus*. It is therefore distinct from the *H. semijunctus*. The photographs are figured for the further illustration of the species. The characters derived from the portions of the skeleton sent by Saml. Powell are as follows:

#### PHYSETER Linn.

#### PHYSETER MACROCEPHALUS Linn.

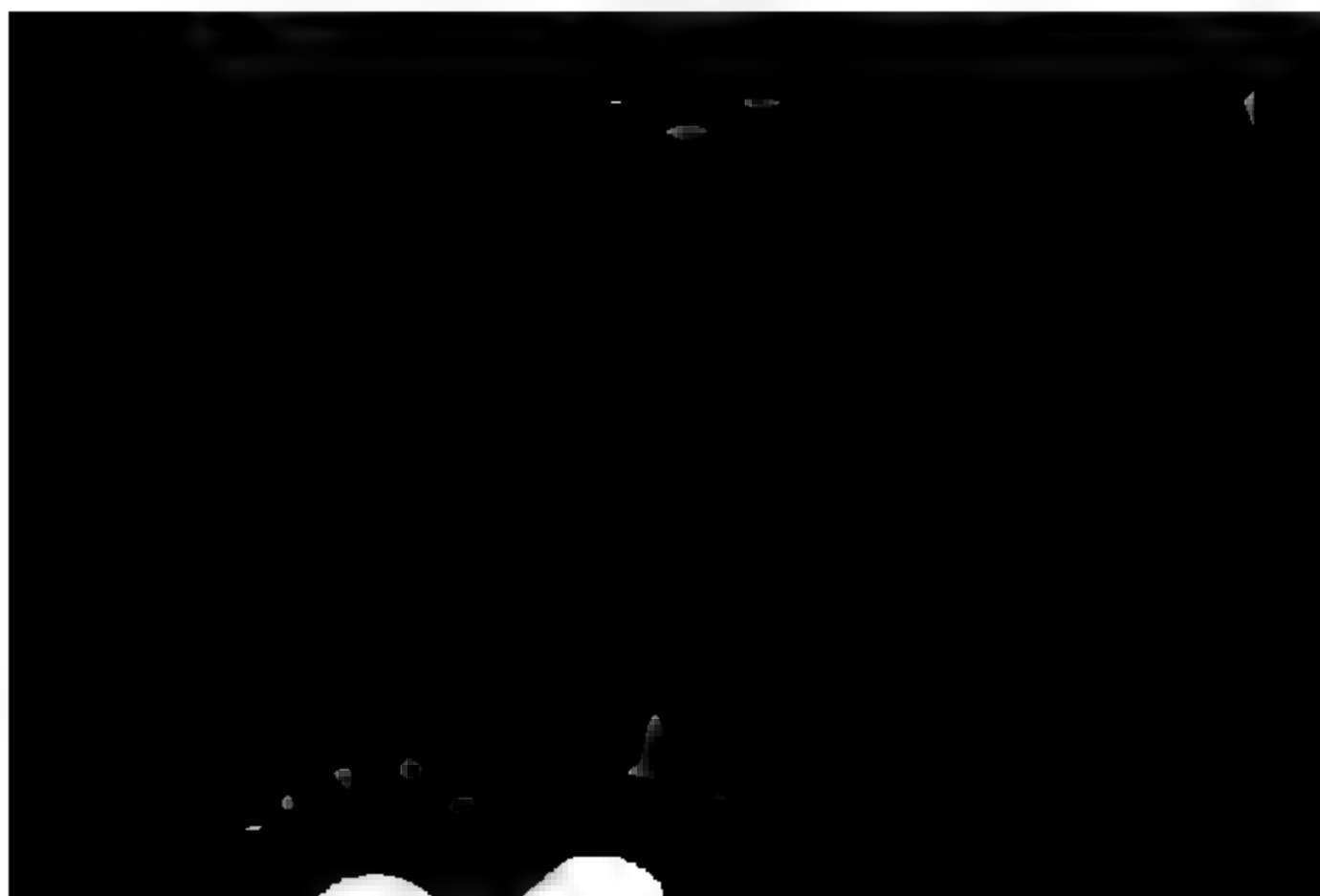
The sperm whale.

This species is one of the few that appear to be distributed over all oceans. Flower does not find those from Australian to differ specifically from those from British seas, and I find no peculiarities by which to distinguish a specimen from our own coast from the latter. This is known from a cranium which was found on the coast of New Jersey and is in the Mus. Compar. Zoology, Cambridge.

### PART II.

#### NATURAL HISTORY

*Of the Cetaceans of the seas off the North-West Coast of America, with an account of the Elephant Seal appended.*



garded as correct in proportions, careful measurements having been taken. All others are the best representations of proportions, and peculiar marks that could be drawn from data obtained.

I have endeavored to confine myself to the simplest and plainest language in description, but in so doing have used whaling terms freely, the definition of which will be found as indicated by reference marks.

Fam. *BALÆNIDÆ*.

I. BOWHEAD WHALE.

*BALÆNA MYSTICETUS* Linn.

This whale has a geographical distribution east and west, extending from Nova Zembla to the coast of Eastern Siberia. It is rarely seen further south in Behring Sea than the 55th parallel, and in the Okhotsk its southern range is about the latitude of 54°.

The northern limit of the Bowhead remains undefined.

In tracing its history we can revert back to the Dutch and Russian fishery about Spitzbergen anterior to 1615,\* and as years passed on it was pursued westward on the Atlantic side to the icy barriers in Davis Strait, and the adjacent waters uniting with the Frozen Ocean.

Right whales were pursued for several years on the North West coast, on the coast of Kamschatka, about the Kurile Islands, and in the Japan Sea, before Bowheads were known to exist in that part of the Arctic Ocean adjoining Behring Strait, or in the Okhotsk Sea.

In the year 1848 Capt. Ross, in the American bark "Superior," was the first whaling master to work his vessel through Behring Strait into the Arctic Ocean, and then found whales innumerable, some of which yielded 200 barrels of oil.

The habits of the Bowhead are much like those of the Humpback, being irregular in its movements, in its respirations, and in the periods of time either above or below the surface of the water. When going gently along, or lying quietly, it shows two portions of the body: the spoutholes, and a part of the back, on account of the high conical shape of the former, and the swell of the latter, which is about midway between the spoutholes and flukes.

The Bowhead of the Arctic may be classed as follows: 1st. The largest whales, of a brown color, average yield of oil 200 barrels. 2d class, smaller, color black, yield of oil 100 barrels. 3d class, the smallest, color black, yield of oil 75 barrels.† This last named class are generally found amongst the broken ice the first of the season, and they have been known to break through when it was three inches in thickness, that had formed over previously upon water between the floes. They do this by coming up under and striking it with the arched portion of their heads. Thence they have been sometimes called "ice-breakers." In point of color, all are found with more or less white on the under side, especially about the throat and fins. The Arctic Bowheads may average from 40 to 65 feet in length.

I am indebted to Capt. J. F. Poole, of the whaling bark "N. S. Perkins," for the following measurements and memoranda of one taken in the Arctic, August, 1867:

Sick female, color black on back and sides, throat white, also occasional white spots on under side of body. Yield of oil, 80 barrels. (The whale was judged large enough ordinarily to have yielded 150 barrels.

	Ft. In.
Length of animal.....	47 0

\* Subsequent datum enables me to date back to 1608.

† We do not mean to convey the idea of *species* when mentioning classes, as all observers of our acquaintance agree that the difference in size and shade of color arises from difference in age.

	Ft. In.
Length of pectorals.....	8
Breadth ".....	4
Distance from nib end to spoutholes.....	16
Length of spoutholes.....	1
Distance from corner of mouth to nib end.....	16
Breadth of flukes.....	19
Thickness of blubber.....	16
Average thickness of blubber.....	11
Thickness of black skin on back.....	1
Length of genital slit.....	1 10
Dist. from " " to arms.....	4
" " " " to flukes.....	9
Length of longest bone or baleen.....	10 6
" of fringe or hair on bone.....	2*
Breadth of widest bone.....	13

Bone is embedded in the gum of the jaw ten inches.

Weight of largest slab of bone, seven pounds.

Number of layers of bone on each side of jaw, 330.†

Bone extends back of spoutholes in throat, three feet; falls short of nib end one foot.

Number of teats, two.

The tongue is very fat, yielding one-tenth as much oil as the whole of the "body blubber."

All Bowheads found on this cruising ground are quite free from parasitic crustaceans, as well as barnacles.

Whalers bound to the Arctic are generally at the "edge of the ice," which is met with, near lat. 60°, about the 1st of May. They then work their way northward as fast as the ice will permit, keeping as near shore as practicable in order to be on the best "whale-ground," and also to avoid the ice. Many whales were formerly taken off Karaginski Island, lat. 59°, on the coast of Kamshatka.

Behring Strait is sufficiently clear of ice from the 1st to the 20th of July for ships to navigate with comparative safety. A large fleet collect, and grope their way through ice and fog into the Arctic (as termed), and frequently reach the high latitude of 72° N. Occasionally an open season occurs, when they hazard their ships around Point Barrow. Capt. Roys entered the ocean the middle of July, and left the 28th of August, but at the present time ships remain till October.

The principal herding places of the Bowheads in the Okhotsk are at the extremities of the coast of water, the most northern being the North-East flat

up and disappears, when there are "no whales about," the question is frequently asked, "where are the whales?" and as often answered, "they are in the ice," and "when do you think they will come out?" "when the ice leaves." It has been established beyond question that this species pass from the Atlantic to the Pacific, or rather, if we may be allowed the expression, from the Atlantic Arctic to the Pacific Arctic, by the north; and, too, it is equally certain that numerous air holes always exist in the ice that covers the arctic waters, even in the coldest latitudes. These fissures are caused by the rise and fall of the tides, and storms acting upon the water hundreds of miles distant has its influence in rending asunder the icy fetters of those frozen seas. It appears to us not improbable that the Bowhead or Polar Whale has a feeding and breeding ground in an open polar sea. And as they have never been seen during the winter months in any other quarter of the globe except as before mentioned, it would appear that they must either remain among the rough water and broken ice at the southern edge of the winter barrier, or migrate to some remote sea unknown to man. Hence may not the clear water that Kane saw after passing the coldest latitudes as he pressed northward, be the winter home of vast numbers of these gigantic animals?

#### OKHOTSK SEA BOWHEADS.

The preceding remarks have been confined chiefly to the Bowheads of the Arctic in the vicinity of Behring Strait, north and south.

The Okhotsk Sea at one time equalled, if not surpassed, the Arctic as a productive whaling ground. Our memorandum does not state with certainty what year Bowheads were first taken in the Okhotsk. It however was not earlier than 1847, nor later than 1849.\*

They were found to be easy of capture, and yielded a large amount of oil and bone. On making further explorations the whales appeared in great numbers, and, from the peculiar shape of the head, the spoutholes terminating in a sort of cone, they were at that time called "steeple-tops."

But few years elapsed before a large fleet were pursuing the animals throughout the whole extent of this vast inland water.

Tchantar Bay, Taousk and Penjinsk Gulfs soon became noted whaling grounds, as well as several other points about the coasts. The whales of this sea, as far as known, are the same species as those of the Arctic, although in the bays are found, in addition, a very small whale called the Poggy, which yields but little oil (20 to 25 barrels).† Many whalers are of the opinion

\* Capt. J. H. Swift, who was cruising in Behring's Sea about the year 1847, is quite positive that the French ship "Asia" was the first to take Bowheads in the Okhotsk (in 1847). Capt. Roys, of Arctic notoriety (spoken of in this paper), in a recent interview seemed equally certain that the "Asia" was not the first to take Bowheads in the sea. He thinks none were taken till 1848 or 1849, and that the American ship "Huntsville," Capt. Freeman Smith, was about the first, if not the *first*, to take Bowheads in that region.

In justice to both of these experienced and very intelligent whaling masters, it is desired to make mention that I am under much obligation to them for valuable data in relation to several species of cetacea, more especially as they are regarded as very correct and close observers of the *habits of whales*.

† We are convinced that there are two species of Bowheads, which are found on the same ground. The difference from the animal above described is a bunch or sort of hump which rises from the top of the *small*, which is situated about six feet forward of the flukes, and extending along the top of the back or small two to three feet, and in some individuals rises in the highest place about six inches. The accompanying sketch will better represent the difference in shape, perhaps, than a written description. Capt. Roys says he has frequently taken them in the Arctic as well as in the Okhotsk. They have been frequently taken in the *North East Gulf* (Okhotsk sea). Our personal observation was only on a dead one in Tchantar Bay (1862), and upon that individual the protuberance was so slight that it would not have been noticed unless our particular attention had been called to it. Capt. Randolph, of the American whaleship "South Boston" (1862), informed me at the time that nearly all the whales he had taken that sea on in the N. E. Gulf were of that description, and yielded a very large amount of bone in proportion to yield of oil.

Capt. Roys also mentioned that one season he took numbers of them, and to distinguish them from others they were then called "Bunch Backs." Several whaling masters who 1869.]

that these are a different species. There is little doubt, however, of their being young whales of the same species, as their blubber is close and fine, producing but little oil in proportion to size of body, as is the case with all calves or young whales of every description.\*

#### BOWHEAD WHALING.

In the Arctic and about Behring Sea the whaling is done from the ship, as it is termed, i. e., the vessels cruise and the look-out is kept aloft as usual, and when whales are seen, the boats are lowered and the pursuit is carried on in sight from the ship, unless obscured by fog. In the Okhotsk much of the whaling is about the bays, particularly Tchantar Bay, and contiguous waters. The nature of the enterprise is such, in these localities, that the *modus operandi* is quite different.

Vessels bound to Tchantar Bay endeavor to approach the land of Aian if the ice will permit, which is generally sufficiently broken and scattered by the 20th of June; then, working along between the ice and the Siberian coast to the southward, as far as practicable with the ships, they dispatch boats to follow along the shore and if possible to reach the head of Tchantar Bay, where whales in former years were expected to be found in large numbers. These boat expeditions were attended with excessive labor, much exposure, as well as risk to the crews. Frequent instances have been known of boats leaving the ships off Aian, then threading their way along the coast, between the masses of ice, or between the ice and shore, as the ebb or flood tides would permit, till they reached the head of Tchantar Bay. As soon as arrived there, finding whales plenty they would immediately commence whaling, and by the time the ships arrived, in several instances, whales enough had been taken to yield 1000 barrels of oil. The elapsed time from leaving the ship till again joining the vessel in the bay would vary from one to three weeks. All this time the boats' crews lived in or around their boats, being afloat when making the passage or when engaged in whaling; and when driven to the shore by the ice or by stormy weather, or resorting thither to cook their food or sleep, the boats are hauled up and turned partially over for shelter, and tents are pitched with the sails. Fallen trees or drift wood furnish abundance of fuel, and by a rousing fire all sleep soundly when opportunity offers; but if whales are in abundance, the less sleep for the whalers, in those high latitudes, where daylight lasts nearly the twenty-four hours of each day during the summer.

#### TCHANTAR BAY WHALING.

Arrived on the ground, whales being plenty, all surplus provisions and outfits are quickly landed and the chase begins. Frequent spouts in the air tell

pooned, it may run for the floe, and before being killed reaches it, and escapes with harpoons, lines, &c. If the pursuit proves successful, the captured whale is towed to the beach at high tide, and a scarf is cut through the blubber along the body, a tackle is made fast on shore and hooked to the blubber, then as the tide falls the animal is literally skinned of its oily hide, the carcass rolling down the bank as the process of skinning goes on. The bone is extracted from the mouth as the body rolls over, and presents the best opportunity. As soon as the blubber is taken off it is *rafted*,\* and lies in the water till taken on board ship. The water being very cold, the blubber remains in its natural state for a long time, retaining the oil with but small loss. While the whaling is going on in this wise, the captain with the *ship-keepers* improves every opportunity to work the ship to the whales. If there is an opening seen between the ice and shore, the ship is at once worked through either by towing, kedging or sailing, and if meeting an adverse tide or wind the vessel is anchored with a very light anchor, so that if beset by ice unexpectedly in the night or during the dense fogs that prevail, the vessel will drift with the floe, thereby avoiding the dangers of being cut through. Heavy fogs prevail until the ice disappears, and the circumscribed clear water being crowded with ships and boats, much care and manœuvering is exercised to prevent accident. These fogs frequently are so dense that no object can be seen much more than a ship's length; consequently at such times cruising and whaling in the bays is full of excitement and anxiety. A ship may be laying quietly at anchor one moment, and the next she is surrounded by a field of ice, or the splashing of water under the bow of a passing vessel tells of her close proximity. Then comes the blowing of horns, the ringing of bells, the firing of guns, or pounding on empty casks, to indicate the vessel's position, in order to avoid collision.

Neither fog or drifting ice, however, prevents the whalers from vigorously prosecuting their work. In thick weather, when the spout of the whale or the animal itself cannot be seen, its hollow-sounding respiration can be heard a long distance. In such instances the boats approach as near as can be judged where the sound was heard, and if the animal is found and captured it is at the risk of the boats coming in contact with passing ships, ice or what not, and, too, not knowing with any degree of certainty what part of the bay they may be in, the first and main object being to capture the whale at all hazards. This being done it is taken in tow by the boats or is anchored. If taken in tow and not finding their own ship, but meeting with another, the custom is to go on board to eat or sleep, if necessary, and when recruited, or the fog lifts so as to find their own vessel, they are supplied with provisions, if needed, till they can reach her. If anchored, one boat always remains with the whale while the others go in search of the ship. As soon as found the master, learning of the capture, makes every effort to work his vessel to the dead animal; or, if that cannot be done, every favorable tide is improved to tow the whale to the ship, where it is cut in and tried out in the usual manner. As the season advances the ice disappears, leaving more room for cruising with the vessels, when the fleet becomes more scattered, and the feature of the whaling changes; the boats are kept more with the vessels, look-outs being stationed at the mast-heads, and the whaling is principally *done from the ship* (as it is called); sometimes two boats are sent from a vessel to look for whales in an adjoining bay. Meanwhile the nights have become longer. Then comes the night whaling. The phosphorescent light caused by the whale's movements in the water show quite distinctly his whereabouts, and, the Bowhead whales being easy of capture compared with other kinds, *night whaling* has been pursued successfully.

We have spoken of the Bowheads as being comparatively easy of capture, but it must not be inferred that the pursuit is not often tedious or unsuccessful, or the attack made without risk of life and limb, as well as in other kinds of whaling.

---

\* Tied together with ropes in a sort of raft.

The Bowhead, compared with the other species of whales that *are pursued*, is considered very shy and timid.

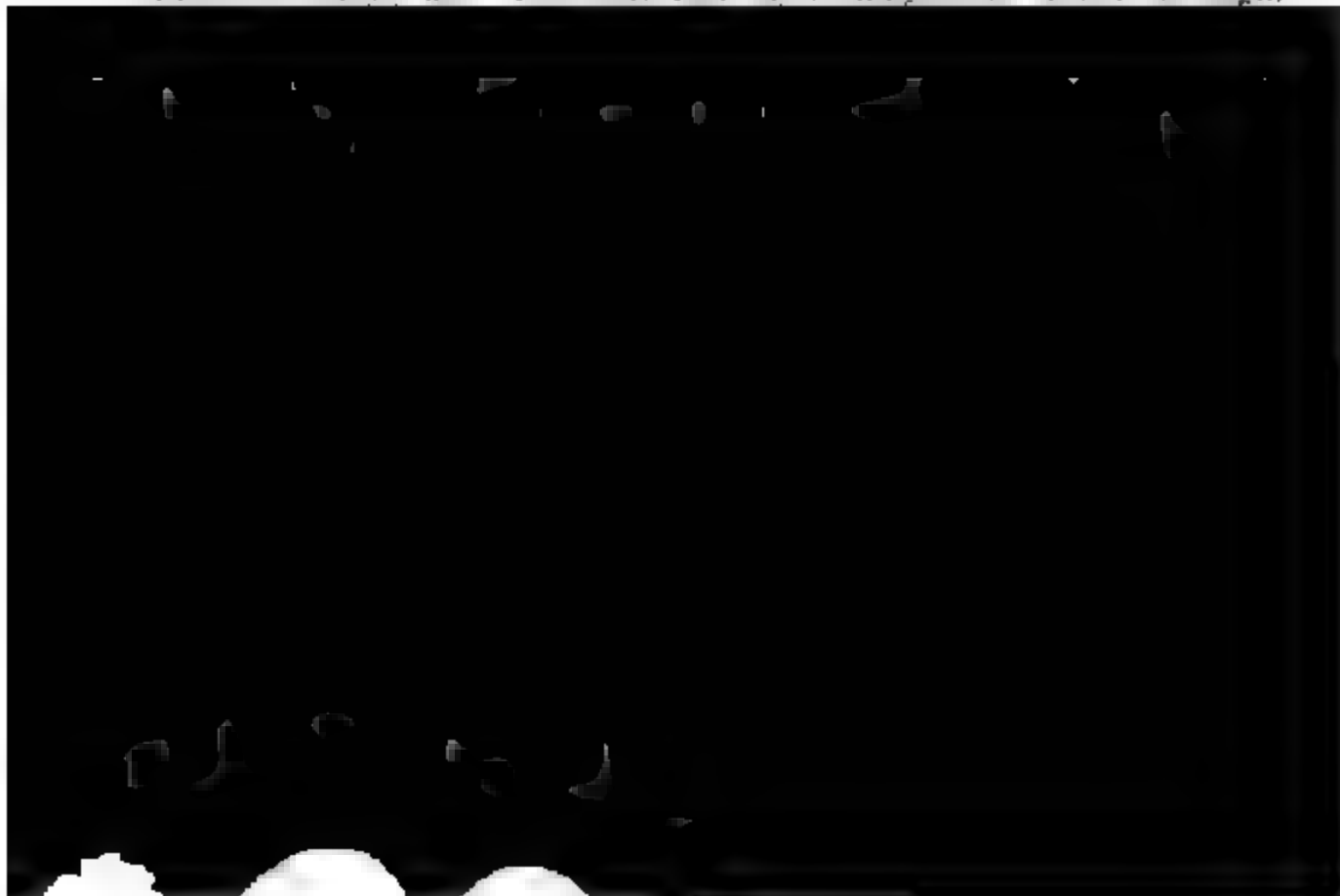
After the ice leaves the bays, until the fall winds begin, much calm weather is experienced; and, although we have frequently seen large numbers of whale spouting among a large number of boats scattered over the water, not a single animal could be approached near enough to *dart at* with the hand harpoon, or to present a fair chance to shoot a bomb lance into it, notwithstanding the boats were rigged with extra large sails in order to take advantage of the light airs or winds that may prevail in midsummer. The use of oars or paddles would be quite sure to frighten the whales, and when there is not sufficient wind to *sail on to them* there is but little or no *chance of getting fast*. After the *irons* are firmly planted in the animal, or, as we frequently hear whalers say, *after the whale has been fastened to, good and solid*, down the creature may go on to the bottom, and there rolls till either the *irons* are torn from its body or the line is wound about it, and the valuable prize may be lost.

The breeding places of the Bowheads seems to be a matter of conjecture among the most observing and experienced whaling masters. The only place known has already been mentioned, in the vicinity of Tchantar Bay, and a difference of opinion exists as to whether the Poggies before mentioned are calves or whether they are not a scrag species that have a corresponding relation to the full-grown Bowheads that the *scrag* Right Whale has to the larger grades of that species. Admitting, however, that they are the young ones, their numbers are comparatively few to the numerous progeny that is supposed to be brought forth by the cows during each season. Another singular fact is that no Bowhead of the Okhotsk Sea have ever been seen passing in or out the passage of the Kurile Islands, or from the Okhotsk to Behring Sea, or Arctic whales passing to the Okhotsk. According to statements of the most experienced whaling captains, a Bowhead with a calf never has been seen by any whalers in the Arctic or Behring Strait, and where this species of cetacean resort to bring forth their young, or where the young remain till grown to a considerable degree of maturity, is not definitely known. The general opinion, however, is that an open Polar Sea must exist, where they resort, or some other open water not known to whalers.

## II. *The Right Whale of the North-West Coast.*

? *BALÆNA CULLAMACH* Cham.

Numerous species of whales frequent the coast of California at different seasons of the year, and both deep sea, bay and shore whaling has been prosecuted for many years. The *scrag* Right Whale was first seen in 1791.



ever been a matter of mysterious conjecture with the most philosophical whalers where this species go to bring forth their young, and where they migrate during the winter months. That they do not go into the southern hemisphere is certain, and it is equally certain that but a few stragglers even reach within a number of degrees of the northern tropic in their wanderings. The same mystery hangs over the breeding place or winter resort of the species of *Balæna* known as the Bowhead.

The Eskimo about the North Western shores of Behring's Sea speak about that species coming into the bays when the "small ice comes," and they look forward to that season as a time of plenty, and reap a kind of marine harvest by catching numbers of them, which yield an abundant supply of food for winter store; so it seems beyond question that this species is quite at home in the beginning of the arctic winter in that region, and the immense numbers of Bowheads and Right whales that would necessarily appear in the temperate latitudes if they migrated southward would be sure to arrest the attention of passing navigators, who frequently go far north, even in the winter season, to make their passages from China and Japan. Some have asserted that they probably congregate around the borders of the drifting or field ice, which joins the open water of the Pacific about the Kurile, and Aleutian Islands. All agree that they do not pass the tropics and reach the southern hemisphere. The southern Right Whales resort to the bays in that region to bring forth their young, and formerly were sought for in those inland waters, where many a ship has quickly completed her cargo by bay-whaling in high southern latitudes. But no bay has yet been discovered north of the equator in the Pacific where the North-West Right Whales go to calve; and, as before mentioned, nothing is definitely known of their winter resort. The last seen of them in high latitudes by whalers is on their return from the Arctic Ocean, when they are found about St. Paul's Island, Behring's Sea, in the month of October, and those found then are usually very large. In the Okhotsk Sea the Right Whale is found toward the northern limits, in the early part of the season; later the ships cruise in the southern part, about the Kurile Islands.

For much of the information about the habits of the Right Whale, and for some of the measurements which have guided us in making our drawing, we are indebted to Capt. Poole, commanding the Bark N. S. Perkins, of San Francisco, and Capt. Baker, of Brig L. P. Foster, which sails from the same port, and Capt. J. M. Green, long known as an experienced whaling master.

The average length of this species may be calculated at sixty feet, the two sexes varying but little in size; average yield of oil 130 barrels, average thickness of blubber ten inches, which appears quite white; yield of bone about 1400 lbs. to a hundred barrels of oil.

The Right Whale is found singly, or in pairs; at times scattered about as far as the eye can reach from the mast head. The last of the season they are sometimes seen in large numbers, crowded together. These herds are called "gams," and they are regarded by experienced whalers as an indication that the whales will soon leave the ground.

The general habit of this animal is to spout seven to nine times to a "rising," then turning flukes (elevating them six or eight feet out of the water) it goes down, and remains twelve to fifteen minutes. It is remarked, however, since they have been so generally pursued by whalers, that their action in this respect has somewhat changed. When "gallied" by the close approach of a boat they have a trick of hollowing the back, which brings the blubber slack, preventing the harpoon from penetrating. Many whales have been "missed" by the boatsteerer's darting at this portion of the body. Having been chased every successive season for years, these animals have become very wild and difficult to get near, especially in calm weather. The manner of propelling the boat at such times is by paddling, and when there is a breeze, by sailing, if practicable, using the oars only when it is not possible to use sails or paddles. Among Right Whalers there is a difference of opinion

1869.]

about "going on to a whale,"\* whether it is best to get out of or into its wake to avoid gallying it; and as regards safety, some prefer to have a good breeze, then, setting all practicable sail, run over the animal to leeward, at the same time that the harpoon is thrown. The whale, after being struck, often runs to windward, thrashing its flukes in every direction, and after going a short distance frequently stops, or "brings to," "sweeping," as it is said, from "eye to eye," and at the same time making a terrific noise through its spout holes, called bellowing; this sound is compared to that of a mammoth bull, and adds much to the excitement in its chase and capture; others will not stop until they are hamstrung, as it were, by "spading." The spading process is performed by hauling the boat near enough to cut the cords that connect the body and flukes, either on top or underneath, as the attitude of the fish may be; a large vein runs along the under side of the "small," terminating at the junction of the caudal fin, which, if cut, will give the animal its death wound. The instrument used for cutting is called a boat spade, which may be compared to a very wide chisel, with a handle six or eight feet long; sometimes the cords are so effectually severed that the flukes become entirely useless, and still the animal slackens its speed hardly perceptibly, showing evidently that its pectorals are its principal propellers. Another mode of stopping them is by throwing a number of harpoons (detached from the line) into its small, a kind of torture that would seem, if the bleeding victim could speak, it would entreat its tormenters to put an end to its misery. But when once "brought to" it will remain nearly stationary for a few minutes or roll from side to side, giving the officer of the boat a good opportunity to shoot a bomb-lance, or use the hand lance with good effect, which soon dispatches it. But sometimes one of these huge animals, in spite of bomb guns, harpoons, and all the whaling craft combined, will, after being fastened to, make the best of its way to windward with the boat, taking it so far from the ship as to oblige the men to cut the line and give up the chase. Of late Greener's gun has been used to some extent in its capture. But before harpoon or bomb guns came into general use, the whaleman of the North-West coast made such havoc among these marine animals (which were regarded the most gigantic and vicious of their kind,) as to have nearly annihilated them or have driven them to some unknown feeding ground.

### III. THE CALIFORNIA GREY WHALE.

#### • RHACHIANOTES GLAUCUS Cope.

*Agaphelus glaucus* Cope, Pr. A. N. Sci. Phil. 1868, 225.

The California Gray is one of the other species of *Rhachianotes* in its color, being of a

bone, or "baleen," of which the longest is fourteen to sixteen inches, is of a light brown color, the grain very coarse; the hair or fringe on the bone, likewise, is much coarser and not so even as that of the Right Whale or Humpback.

The male may average thirty-five feet in length, but varies more in size than the female, and the average quantity of oil it produces may be reckoned at twenty-five barrels.

The California Grey is only found in north latitude, and its migrations have never been known to extend lower than 20° north. It frequents the coast of California from November to May. During these months the "cows" enter the lagoons on the lower coast to calve, having one young at a birth;\* while the males remain outside, along the sea shore. Occasionally a male is seen in the lagoons with the cows the last of the season, and soon after both male and female, with their young, will be seen working their way northward, following the shore so near that they often pass through the kelp near the beach. It is seldom they are seen far from land.

Their habits are strikingly different from those of other species of *Balæna*, in resorting to shoal bays and lagoons to bring forth their young. In summer they congregate in the Arctic Ocean and Okhotsk Sea. It has been said that this species of whale is found on the coast of China, but this report needs confirmation. In October and November they appear off the coast of Oregon and Upper California, on their way back to their tropical haunts, making a quick, low spout at long intervals, showing themselves but little till they reach the smooth lagoons of the lower coast, where, if not disturbed, they congregate in large numbers, passing into and out of the estuary, or slowly raising their massive forms midway out of their element and falling over on their sides, dashing the water into foam and spray about them. At times in calm weather they are seen lying on the water quite motionless, keeping one position for an hour or more.

The first time we were in Scammon's Lagoons the boats were lowered several times for them, we thinking that the whales when in that position were dead or sleeping, but before the boat approached within darting or even shooting distance they were on the move again.

About the bar and shoals at the mouth of one of the lagoons, in 1860, we saw large numbers of California Grays; it was at the low stage of the tide, and the shoal places were plainly marked by the constantly foaming breakers. To our surprise, we saw numbers of these "Grays" going through the surf where there could barely have been depth to float them. We could see in many places, by the white sand coming to the surface, that they must be near to or touching the bottom. One in particular lay for a half hour in the breakers playing, as we have often seen seals in a heavy surf, turning from side to side with half extended fins, and moved apparently by the heavy ground swell which was breaking, at times making a playful spring with its bending flukes, throwing its body clear of the water, coming down with a heavy splash, then making two or three spouts, then settling under water, and perhaps the next moment his head would appear, and with the heavy swell the animal would roll over in a listless manner, to all appearance enjoying the sport intensely. We passed close to this playful fellow, and had only thirteen feet of water.

#### Hunt, Chase, and Capture—Dangers of Lagoon Whaling.

As the season approached for the whales to bring forth their young, which

---

\* Two or three calves have been seen with one whale, but these instances have only occurred in lagoons where there had been great slaughter among the cows, leaving their offspring motherless, which straggle about, sometimes following other whales, or congregating by themselves, a half a dozen together at times. We know of one instance when a whale was killed close to the ship which had a calf perhaps a month old. When the mother was taken to the ship to be cut in, the young one followed, and remained playing about for two weeks, but whether it lived to come to maturity is a matter of conjecture.

is from December to March, they formerly collected at the most remote extremities of the lagoons, huddled together so thickly that it was difficult for a boat to cross the waters without coming in contact with them accidentally. Frequent instances have been known of their getting aground, and lying for three or four hours with but two or three feet of water around them, without apparent inconvenience or injury from lying heavily on the sandy bottom till the rising tide floated them again.

In February, 1856, we found two aground in Magdalena Bay. Each had a calf playing about; there being sufficient depth for the young ones, while the mothers lay hard on the bottom.

When attacked the smaller of the two old ones laid motionless, and the boat approached near enough to "set" the hand lance into her "life," dispatching her at a single dart. The other, however, when approached would raise head and flukes above the water, supporting herself on a small portion of the belly, turning easily, and heading towards the boat, which made it very difficult to capture her. It appears to be their nature to get into as shallow water as will float them when their calves are young. For this reason, the whaling vessels anchor a considerable distance, sometimes two or three miles, from where the crews go to hunt them. Several vessels are often in the same lagoons. The first streak of dawn is the signal for lowering the boats, all pulling for the head waters, where the whales with their calves are found. As soon as one is seen, the officer who first discovers it sets a waif in his boat, heads for the whale, and gives chase. Boats belonging to other vessels do not interfere, but go on in search of more whales. When the boats are in chase, great care is taken to keep behind and a short distance from the whale, till driven near the head of the lagoon or into shallow water; then the men in the boats nearest spring to their oars in the exciting pursuit. At such times the animal swims so close to the bottom as to impede its progress, thereby giving the boat a decided advantage; but occasionally the whale will suddenly change its course, or dodge, especially if she has a calf that is old enough to swim fast. Under such circumstances the chase will frequently last for hours, the boats cutting through the water at their utmost speed. At other times, when the calf is young and weak, the movement of the mother is very slow, keeping close to her young and giving it all the protection and assistance which her nature affords. It is an unusual occurrence for the mother to forsake her offspring when molested. When within "darting distance" (sixteen or eighteen feet), the boat steerer darts the "irons," and when the whale is struck it dashes about, lashing the water into foam, frequently even staving the boats. As soon as the boat is "fast" the officer goes into the head,\* and watches a favorable opportunity to

generally known, and the bomb gun\* coming into general use, has changed the mode of capture along the coast.

Parties of whalers have for several years established themselves along the shore at the most favorable points where the thickest beds of kelp are found, and there lay in wait watching for a good chance to shoot the animals as they migrate to their southern breeding grounds and return again to the north. This by whalers is called "kelp-whaling." The first year or two that this kind of whaling was pursued, many of them passed through or along the edge of the kelp, giving the gunners an opportunity to choose their own distance for a shot. This manner of capture, however, soon developed the sagacity of these periodical visitors. At first the ordinary whale boat was used, but the keen-eyed devil-fish soon found what would be the consequence of getting too near the long dark-looking object, as it lay nearly motionless in the kelp, only rising and falling with the rolling swell.

A very small boat, with one man to shoot and another to scull, was then used instead of the whale boat and crew; this proved successful for a time, but as season after season passed the whales worked more off shore, and at the present time the boats anchor a little outside the kelp as a general rule. The whale being seen approaching at a distance far enough for the experienced gunner to judge pretty nearly where the animal will "break water," near to this place the boat is sculled to await the "rising." If the whale "shows a good chance," it is frequently killed instantly and sinks to the bottom, or receives its death-wound by the bursting of the bomb-lance. Consequently the stationary position or slow movement of the animal enables the whaler to get a harpoon into it before sinking. To the harpoon a line is attached, with a buoy at the end, which indicates the place where it lies on the bottom. Usually in the course of twenty-four hours, and often in much less time, the whale rises to the surface, and is then towed to the shore, the blubber taken off, and tried out in pots set for that purpose on the beach.

Another mode of capture along the coast is by the ships cruising a little way off shore, sending the boats inshore, towards the line of kelp, and as the whales pass to the southward, the boats being provided with extra large sails and the whalers taking advantage of the strong northerly winds which prevail, run their boats before the wind, sailing near enough to dart the ordinary hand harpoon into the animal, getting fast this way. The whale is killed in deep water, and if inclined to sink, it can usually be held up by two boats, till the ship comes to them, when a large "flake-rope" is made fast or the "fin-chain" is fastened on its fins, the "cutting tackle" hooked, and the whale "cut in" immediately. This manner of taking the whale is called "sailing them down."

Still another way of catching them is with Gruner's Harpoon Gun, which is similar to a small swivel gun. It is of one and a half inch bore, and three feet long in the barrel, and when stocked and complete weighs seventy-five pounds. The harpoon, four feet and a half long, is projected with considerable accuracy to any distance under eighty-four yards. It is mounted on the bow of the boat, and was formerly fired by the boat steerer who pulls the harpooner's oar. This was the old Scotch plan, the gun being first used by the Scotch whalers; but at the present time it has been more successfully managed by the officer in charge of the boat, who takes the boat steerer's place for the time. A variety of manœuvres are practised with the boat when using the harpoon gun; at times lying at anchor as in deep whaling, at other

---

\* The bomb gun is made of iron, stock and all. It is three feet long, the barrel of which is twenty-three inches in length; diameter of bore, one and one-eighth of an inch; weight, twenty-four pounds. It shoots a bomb lance twenty-one and a half inches long, and of a size to fit the bore. It is pointed at the end, with sharpened edges, in order to cut its way through the fibrous fat and flesh, and is guided by three elastic feathers, which are attached along the fuse tube, folding around it when in the barrel. The gun is fired from the shoulder, in the same way as a musket.

times drifting about for a chance shot, or paddling quietly if in calm weather, and when a breeze comes sailing after the animal. When the whale is judged to be ten fathoms off, the gunner sights eighteen inches below its back; if fifteen fathoms, eight or ten inches below; if eighteen or twenty fathoms distant the gun is pointed at the top of the back. Twenty fathoms is considered a long range, as there is constantly more or less motion to the boat.

Groner's gun, as a general thing, has not been brought into successful use among American whalers, except for this peculiar species of whale, along this coast, where much of the time the water is quite smooth—during the winter months. It has been used of late with great success, the harpoon being so effective a weapon as often to give the whale a death-wound, and in some instances killing instantly.

Still another strategic plan has been practised with successful results, called "whaling along the breakers." Mention has been made of one prominent habit of these periodical visitors to the coast, evidently taking great delight in playing their uncouth gambols through or along the breakers that front the mouths of the lagoons. This the watchful eye of the whaler was quick to see could be turned to his advantage and to the destruction of this interesting marine animal, when exhibiting its natural habits. They will pass through the surf where there is scarcely water to float them, and frequently are seen along the edge of the breakers, and in making their passage north and south they follow along the outlying shoals as they once did along the kelp.

After years of pursuit by waylaying them around the beds of kelp, the wary animals learned to shun those points of death, and seemingly made a wide deviation in their course to enjoy the sport among the rollers of the lagoons' mouths, as they passed them either way. But the civilized whaler, their greatest enemy, ever ready to destroy for gain, anchors his boats as near the roaring surf as safety will permit, and the unwary "fish" that comes in reach of the deadly harpoon, or bomb, is very sure to pay the penalty with its life. If the whale comes within darting distance, he is harpooned, and as they almost invariably run "off shore" they are soon in clear deep water, where the pursuer makes his capture with comparative ease; or, if passing within range of the bomb gun, one of the explosive missiles is planted into its side. This usually so paralyzes the animal that the first boat's crew, who have been resting at anchor, taking to their oars, soon overtakes the wounded animal, which is fastened to and despatched in a summary manner.

The casualties occurring in connection with the coast and kelp whaling are nothing to be compared with the accidents that have been experienced by the coast whalers, in the open sea. It is a fact that



whale is struck, it often stops suddenly, and the speed of the boat, together with the influence of the running water, prevents it from being kept clear, notwithstanding the utmost caution and exertion to avoid accident, the boat shooting against or over the animal, when it is dashing the water in every direction. The whales that are given chase to have a calf with them, and the mother, in her endeavors to avoid the pursuit of herself and offspring, will sometimes lose sight of her calf in the thick water. Instantly she stops, "sweeping" around in search of the lost one, and at such times if the boat comes in contact with her, it is almost certain to be stove. Another great danger is in killing the calf. At times, when the harpoon is thrown or the lance darted at the mother, the calf, in its innocent gambols about the parent animal, will get in the way of the weapon, and receive the wound, killing it instead of the intended victim. In such cases the whale in her frenzy will chase the boats, and overtaking them will overturn them with her head or dash them in pieces with a stroke of her flukes. Sometimes the calf is fastened to instead of the cow. In such instances the mother may have been an old frequenter of the "ground," and before chased perhaps suffered from attack, consequently is more difficult to capture, staving the boats and escaping after repeatedly receiving wounds. One instance occurred in Magdalena Lagoon, in 1857, where, after several boats were stove, they being near the beach, the men in those remaining afloat managed to pick up their swimming comrades and in the meantime to run the line to the shore, hauling the calf into as shallow water as would float the "dam," she keeping near her troubled young one, giving the gunner a good chance for a shot with his bomb-gun from the beach. A similar instance occurred in Scammon's Lagoon in 1859.

The testimony of many officers of whaling vessels furnishes abundant proof that this species of whale is possessed of unusual sagacity, and their inordinate affection for their offspring is beyond question. Numerous contests with them prove that after the loss of their young the enraged animal has given chase to the boats, which only found security by pulling into shoal water or to shore. The many mishaps that have been experienced among a class of men that are fond of listening to tales of adventure or relating their own exploits have been the sources from which many a marvellous though truthful tale has sprung.

---

Indian Whalers of the North-West Coast.—Indian Whaling Canoe.—Indian Whaling Craft.—Indian Whaling.—Disposition of the Whale after Captured.—Description of the Eskemo Whaleboat.—Eskemo Whaling Implements.—Division of the Captured Whale.—Closing Remarks.

After evading the civilized whaler and his instruments of destruction, or suffering from wounds received while in their southern haunts, these migratory animals of both sexes begin their northern journey.

The mother with her young, grown to half the size of maturity, but wanting in strength, make the best of their way along the shores, avoiding the rough sea by passing between or near the rocky islets which stud the points and capes. But scarcely have they quitted their southern homes before they are surprised by the Indians about the Strait of Juan De Fuca, Vancouver's and Queen Charlotte's Island. Like enemies in ambush, they glide in canoes from island, bluff, or bay, rushing upon them with whoop and yell, launching their instruments of torture into them, like hounds worrying the last life-blood from their vitals, and then trains of canoes tow the captured ones to shore in triumph. The whalers among the Indians of the north-west coast are those fond of the height of adventure, and likewise of becoming worthy of the greatest consideration among their fellows. The one among them that could boast of killing a whale formerly had the most exalted mark of honor conferred upon him by a cut across his nose.\*

---

\* This custom is no longer practiced.

The whaling canoe is from thirty to thirty-five feet long; eight men invariably make the crew, each wielding a paddle five and a half feet long. The whaling craft consists of harpoons, lances, lines, and sealskin buoys, all of their own workmanship.

The harpoon is much the shape of the head of the common lance used by our whalers, adding two pieces of pointed bone projecting from one of the edged sides of the weapon. Its length is six and a half inches and its width two and a half inches. It is composed of sheet iron, bone, the fibers of cedar roots, or of the wild nettle, and gum. The iron forms the *principal* and cutting part, and is perforated from midway to the end that joins the line. "Formerly the muscle-shell was used to make this blade." The horns of bone which extend from one edged side as before mentioned, are placed one on each flat side of the iron; the rope unlaid and marled on with the pieces of bone, through the holes in the sheet iron blade, and the whole covered with a coating of gum. The rope, bones, and seizings, form a cavity, into which the pointed end of the harpoon pole or staff is inserted. This pole—made of yew—is eighteen feet long and weighs about nineteen pounds. It serves the double purpose of harpoon-staff and lance-pole.

The lance is of the same shape as the harpoon, without the barbs or horns, and adding the socket for the lance-pole. The blade is made of a muscle-shell, and the socket is formed of cedar bark "wounded" or "served" with fibrous roots, the whole gummed in like manner as the harpoon. Its length is seven inches, and it is two and a half inches wide.

The line is made of cedar withes, twisted into a three-strand rope five-eighths of an inch in diameter, and looking very much like coir rope; the usual length of the line is fifty to sixty feet for the first harpoon, but the buoys attached to the harpoons subsequently thrown have only about five feet of line.

The buoys are prepared seal skins with flipper holes and mouth secured air tight; one flipper hole is fitted with a nozzle, for the purpose of blowing it up when required for use. These buoys are fancifully painted, according to the taste of the owner of the canoe to which they may belong, care being taken that each canoe's buoys are differently marked.

Their whaling grounds are limited, as the Indian whalers rarely venture seaward far out of sight of the smoke from their habitations by day, or beyond view of their bonfires at night.

The number of canoes engaged in the chase is from two to five, each one of the crew being from among the chosen men of the tribe, who can with silent stroke paddle the sharp, symmetrical caum\* close to the rippling water along the sides of the animal. The bowman then, with sure aim, throws his lance, and the harpoon is cast, the line is attached to the harpoon, and the chase begins.



—the rude weapon being cautiously handled to prevent accident to the craft by contact with the dashing flukes and fins of the whale. This careful manœuvring subjects the bleeding animal to a system of torture characteristic of the savage horde about it, and eventually, bleeding its last blood from a lacerated heart, it writhes in convulsions and expires. Immediately after the whale is dead, the whole fleet of canoes assist in towing it to the shore. As soon as the prize is brought to the beach a division is made, and all the inhabitants of the village gorge themselves upon its fat and flesh till their greedy appetites are satisfied. After the feast, what oil can be extracted from the remaining blubber is put in skins or bladders, and becomes an article of traffic with neighboring tribes, or the white traders that frequently visit them.

This *whale of passage*, when arrived among the scattered floes of the Arctic Ocean, is rarely pursued by the whaleship's boats, consequently they rest in some degree of security; but even there, when a favorable opportunity offers, the watchful Eskemos steal upon them and with their rude weapons and torturing process, the whale pursued, at last yields to the combined enemies about it, and supplies food and substance for its captors.

The Eskemo whaling boat, although to all appearances simple in its construction, will be found, after careful investigation, to be admirably adapted to the purpose, as well as for all other uses necessity demands. It is not only used to accomplish this the most important undertaking within their frozen imaginations, but in it they pursue the walrus, shoot game, and make their long summer voyage about the coast, up the deep bays and long rivers, for the purpose of traffic with coast and interior tribes.

When they prepare for whaling, the boat is cleared of all passengers and their effects, nothing being allowed in it but the whaling implements and boat gear. Eight picked men make the crew.\* Their boats are twenty-five to thirty feet in length, flat on the bottom, with flaring sides and tapering ends; there are four thwarts which are placed about midway between the bottom and the gunwales. The frame is of wood, and consists of fourteen or sixteen ribs, a center-piece along the bottom, stern and bow timbers and strips run along each side to receive the thwarts and give shape to the craft. The frame is lashed or served together, with the fibres of whalebone and thongs of walrus' hide, the latter article being the covering or planking to the boat.

The whaling implements are one or more harpoons of their own make, four seal-skin buoys, a line made of walrus hide, one end of which is fastened to the harpoon, the other to one of the buoys, a boat mast that serves the triple purpose of spreading the sail, and furnishing the staff for harpoon and lance, a large knife or two, and eight paddles.

The harpoon is made out of the walrus tusk, with a piece of stone or iron fitted in the end for a point; it is nine inches long, three-fourths of an inch in average thickness; width one inch and three-eighths, tapering a little towards the pointed end. The socket end is of a diagonal shape, the better to catch the flesh; in the middle or nearer the socket end, a hole is made to receive the strap of walrus hide to which the line is fastened. The point end has a triangular-shaped piece of thin iron or stone inserted in it—as before mentioned—which completes the weapon. In the socket end of this harpoon the small end of the boat mast is fitted, and serves as the harpoon staff. A common butcher knife, the blade fourteen or sixteen inches long—which they purchase from whale ships or trading vessels—lashed to the boat mast constitutes the lance.

The boat being in readiness the chase begins. As soon as the whale is seen and its course ascertained, all get behind it; not a word is spoken, nor will they take notice of a passing ship or boat, when once excited in the chase.

---

\* It is said by Capt. Norton, who commanded the ship "Citizen," wrecked in the Arctic several years since, that the women engage in the chase.

All is silent and motionless till the whale spouts, when with instant dash all paddle towards it. The moment the spouting is over, every paddle is raised from the water. Again the spout is seen, or in thick weather heard through the fog—again they spring to their paddles. In this manner the animal is approached near enough to dart the harpoon, when all shout at the top of their voices and make all the noise possible. This is said to have the effect of checking the animal's progress, till the harpoon is planted in its body with line and buoy attached. The chase is continued in like manner until a number of weapons are fastened, causing the whale much effort to get under water and still more to remain down; consequently it soon rises again, and is attacked with renewed vigor. In a short time it becomes so much exhausted that the boat can, without much risk, go close to it. It is an acknowledged right with them for the man that first harpoons the whale to take command of the whale party. Accordingly, as soon as the proper time arrives his "baidarra" is paddled close to the whale, and with surprising quickness he cuts a piece of blubber from its side large enough to admit a knife and the boat mast to which it is lashed. Then the cutting and piercing begins, and is continued till the whale is in his death struggles. The capture being made and the whale towed to the shore, it is divided as follows: Each member of the party receives ten slabs of bone, and a like proportion of the blubber and entrails; the owners of the canoes take the remainder.

The choice pieces for a dainty repast with them are the flukes, lips and fins. The oil is a great article of trade with the interior tribes of reindeer men; it is sold in skins, containing about fifteen gallons each, a skin of oil being the price of a reindeer. The entrails are made into a kind of sauce by pickling them in a liquid extracted from a root that imparts an acrid taste. The preparation is a savory dish among them as well as a preventative of the scurvy. The lean flesh of the whale supplies food for their dogs, the whole canoe horde of the village assembling where the carcass lies, fighting, feasting, growling and howling, as only Eskimo dogs can.

Many of the prominent habits of the California Gray are widely different from those of other species of *Balaena*. It makes its regular migrations from the hot southern latitudes to beyond the Arctic circle, and in these passages between the antipodes of climate it follows the general trend of an irregular coast so near that it is exposed to attack from the savage tribes inhabiting the sea-shores, who pass much of their time in the canoe, and make the capture of this piebald animal a feat of the highest distinction. As it approaches the genial waters of the torrid zone it presents an opportunity to the civilized whalers, at sea, along the shore, and in the lagoons, to practice their different modes of strategy, that hasten its annihilation. It manifests inordi-

The civilized whaler seeks the hunted animal farther seaward, as from year to year it learns to shun the fatal shore. No species of the whale tribe is so constantly and variously pursued as the one we have endeavored to describe, and the large bays and lagoons where once these animals congregated, brought forth and nurtured their young, are now nearly deserted. Their mammoth bones lie bleaching on the shores of those placid waters, and are strewn along the broken coasts from Eastern Siberia to the Gulf of California. Ere long the California Gray will be known only as one of the extinct species of Cetacea recorded in history.

IV. THE HUMPBACK.

MEGAPTERA VERSABILIS Cope.

Description of the Animal—Measurements—Vermin Infesting Whales—Barnacles—Time of Bringing Forth the Young—How Captured—Favorite Feeding Grounds on the Coast

The Humpback is one of the species of Whale that roam through every ocean, generally preferring to feed and play its uncouth gambols near extensive coasts, or about the shores of islands, in all latitudes except the frozen polar regions.

It is irregular in its movements, seldom going a straight course for any considerable distance ; at one time moving about in large numbers, scattered over the sea as far as the eye can discern from the masthead, at other times *singly*, seeming as much at home as if it were surrounded by hundreds of its kind ; at will performing the varied actions of breaching, rolling, fining, lop-tailing, or scooping ; or, if a calm sunny day, perhaps lying motionless on the molten-looking surface, as if life were extinct.

Its shape, compared with the symmetrical forms of the Finback, California Grey, or Sulphurbottom, is decidedly ugly, a short body with immense belly, and frequently diminutive “small,” inordinately large pectorals and flukes. A protuberance, of variable shape and size in different individuals, placed on the back about one-fourth the length from the flukes, is called the hump. All combined impress the observer with the idea of abnormal proportions. The top of its head is dotted with irregular rounded bunches, that project above the surface about a half inch, each covering about two inches of space.

The following measurements and memoranda were taken by Capt. F. S. Redfield, of the whaling and trading brig “Manuella,” while cruising in Behring Sea, September 17th, 1866 :

	Ft.	In.
Extreme length.....	49	7
Length of pectorals.....	13	7
Breadth “.....	3	2
Distance from snout to pectorals .....	12	0
“ “ corner of mouth to snout.....	12	0
“ “ eye to snout.....	12	6
“ “ spoutholes to snout.....	10	0
Breadth of flukes.....	15	7
Depth “.....	3	4
Distance from arms to flukes.....	11	6
“ “ genital slit.....	17	0
Length of folds on belly.....	16	0
Whole breadth of folds on belly.....	10	0
Distance from flukes to hump .....	12	3
Length of hump along the back.....	3	0
Height of hump.....	1	0
Depth of small close to flukes.....	2	6
Thickness of small close to flukes.....	1	6

1869.]

Number of folds on the belly twenty-six, averaging in width from four to eight inches. Thickness of blubber five to ten inches. Color a yellowish white. Yield of oil forty barrels.\*

Color of body black, under side of pectorals white. Frequently the under side of the flukes is white likewise, and sometimes the greater portion of the belly. The Humpback, as well as all other whales except the Bowhead or Arctic whale, are infested with parasitic crustaceans, which collect about the head, particularly near the spoutholes, and if there are any scars or sores on the animal's body, this vermin is sure to find them.† They vary from as small as can be discerned with the naked eye to one inch in length, and are of a straw color, furnished with numerous legs, disposed in a row on each side of the body, and a mouth that at least gives a sharp bite to human flesh.

The Humpback has also growing on its body what are termed barnacles, which appear to collect most on the fins, flukes, and head. This barnacle is entirely different from that found on a vessel's bottom, timber, rocks, &c., being flat on the side that adheres to the skin, the edges forming a circle, the mouth or opening being in the centre and protected by a rounded, bony or stony substance, the exterior of which is creased into a rough surface, and in color nearly white, or mottled with black. The size of the barnacle varies from half an inch to two and a half in diameter, and from one-fourth to three-fourths of an inch in thickness.

The peculiar undulating movement of the Humpback, its frequent roundings, turning flukes, and irregular course, are characteristic habits that the quick and practised eye of the whaler can distinguish at a long distance. Like all other whales it has two spoutholes, and when it respire, the breath and vapor ejected through these apertures forms the "spout," which rises in two separate columns, joining in one as it ascends and expands. When its enormous lungs are brought into full force the spout rises twenty feet or more. When the whale is going to windward the influence of the breeze upon the vapor is such that a low "bushy" spout is all that can be seen. The number of "spoutings to a rising" is exceedingly varied, sometimes blowing only once, at another six, eight or ten, and from that up to fifteen or twenty times.

From observations made along the coasts of the North and South Pacific in regard to their times and places of resort for the purpose of bringing forth their young, we deduce the following:

In the year 1852—3 large numbers of Humpbacks resorted to the Gulf of Guayaquil, coast of Peru, to calve, and the height of the season was during the months of July and August. The same may be said of the gulfs and bays situated near the corresponding latitudes north of the equator. Still, as stated

habit they are found on different coasts in all latitudes between the freezing points, from the young one but a few days old to those of extreme maturity.

They are captured with the common hand harpoon and lance, adding the use of the bomb-gun, and as they are very liable to sink when dead, every exertion is made to get the harpoons in before the gun is discharged. The best points for Humpback whaling on the coast have been Magdalena, Ballenas, and Monterey Bays.

## V. THE SULPHURBOTTOM.

*SIBBALDIUS SULFUREUS* Cope.

The largest whale found upon the coast, if not the largest known, is the Sulphurbottom.

Never having had an opportunity of obtaining an accurate measurement of its proportions, I can only state them approximately.

Length seventy to ninety feet; the body is comparatively more slender than the California Gray; the pectorals and caudal fin may be regarded as being in like proportion to the body as those of the Finback and the "Gray." The color is somewhat lighter than in the former on its back and sides, but underneath it is of a yellowish cast, or sulphur color: hence the name Sulphurbottom is supposed to have been given. The dorsal fin is much smaller than that of the Finback, and is a little nearer the flukes, but the head, throat and bone in shape is similar to that species.

A Sulphurbottom is found in the Atlantic as well as in the Pacific. The Pacific species occurs at all seasons on the coasts of the Californias. During the months from May to September they are often found in large numbers close in with the shore, at times playing about ships at anchor in the open roadsteads, near islands or capes, but as a general rule they do not approach vessels with the degree of boldness that the Finback does.

The Sulphurbottom is considered the swiftest whale afloat, and for this reason is but seldom pursued and still more rarely taken. Capt. Thomas, of the bark *Lagrange*, in 1857, off St. Bartolme Bay, caught one by first shooting a bomb-lance into a vital part; and, although the whale ran a long distance before "turning up," they were enabled to keep trace of it among the large number around by its spouting blood. When the animal was nearly exhausted, the boats approached near enough to get fast, which was done and the capture completed. This one yielded about ninety barrels of oil, and measured eighty-five feet in length. The schooner "*Page*," of San Francisco, succeeded in taking several near Ascension Island, the vessel laying at anchor under the lee of it, the capture being made with the bomb-gun and lance. Notwithstanding that a large proportion of these whales sank as soon as dead, they were enabled to save them, the water being of moderate depth, in consequence of which the whales rose to the surface before decomposition was far advanced. The size and yield of those taken by the "*Page*" compared favorably with the one taken by the "*Lagrange*."

Several days' trial was made in the brig "*Boston*," in 1858, off Cenos Island, to capture these animals. It was the month of July, and the sea, as far as the eye could discern, was marked with their huge forms and towering spouts. Ten were bombed by the best shooters, who affirmed that they chose their "chance," but as soon as the gun was discharged the whale would disappear, and that was the last trace seen of it, except a patch of foam, sometimes mixed with blood. On the last day of pursuit, toward the evening, another vessel appeared in the offing and approached within a mile or less, when the last trial bomb was fired and the men in the boats looked eagerly to the rising of the wounded whale, but in vain. A signal was made from the approaching ship that they had seen it, as it "broke water" close to the vessel, and it soon rolled over and sank. The swiftness of this animal, under water, as demonstrated at this time, appeared to make it impracticable to pursue them.

1869.]

Doubtless several of those fired at received mortal wounds, or were killed outright, but their propensity to sink, and also to "run under water," baffled the skill of the whalers to secure them.

## VI. THE FINBACK.

*BALÆNOPTERA VELIFERA* Cope.

Another species of the Whale tribe is known as the Finback.

One picked up by Capt. Poole, of the bark "Sarah Warren," of San Francisco, affords us the following memoranda: Length sixty-five feet. Thickness of blubber seven to nine inches. Yield of oil seventy-five barrels. Color of blubber a clear white. Top of head quite as flat and straight as that of the Humpback. Baleen, the longest two feet four inches, greatest width thirteen inches, its color a light lead streaked with black, and its surface presents a ridgy appearance crosswise; length of fringes to bone two to four inches, and in size this may be compared to a cambric needle.

Its side fins and flukes are in like proportion to the body as in the California Gray. Its throat and breast are marked with deep creases or folds, like the Humpback. Color of back and sides black or blackish-brown; belly a milky white. Its back fin is placed nearer to the caudal than the hump on the Humpback, and in shape approaches to a right-angled triangle, but rounded on the forward edge, curved on the opposite one, and the longest side joins the back in some individuals; in others the anterior edge is the longest.

The habits of the Finback in several points are peculiar. When it respire the breath passing through its spoutboles produces a sharp sound that is quite distinguishable from that of other whales of the same genus. It frequently gambols about vessels at sea, in mid ocean as well as close in with the coast, darting under them or shooting swiftly through the water on either side, at one moment upon the surface, belching forth its quick ringing spout, and the next instant submerged deep beneath the waves. In beginning the descent it assumes a variety of positions, sometimes rolling over nearly on its side, at other times rounding or perhaps heaving its flukes out and assuming nearly a perpendicular attitude. Frequently it remains on the surface, making a regular course and several uniform blows. Occasionally they congregate in schools of fifteen to twenty or less. In this situation we have usually observed them going quickly through the water, several spouting at the same instant. Their uncertain movements, however, often showing themselves twice or thrice, then disappearing, and their swiftness, make them very difficult to capture. The results of several attempts to catch them were as fol-

boats and gave chase. On coming up with them they were found to be Finbacks. One was harpooned, and, although it received a mortal wound, they all "run together" as before. One of the gunners, being an expert, managed to shoot the whole five, and they were all ultimately secured, yielding to the captors a merited prize. We have noticed more of these whales along the coast during the summer months, and they seem to be more together then; but, as the opportunities for observing their habits have been much greater at that season of the year, we may have been led into error in this particular point. On the northern coast the Finbacks, in many instances, have a much larger fin than those in warmer latitudes, and I am fully satisfied that these are a distinct species, confined to the northern waters.

We have had but little opportunity to observe the Finbacks that frequently rove about the Gulf of Georgia and Juan de Fuca Strait. Several have been seen, however, in May and June, on the coasts of California and Oregon, and in Fuca Strait in June and July of the present year; these observations satisfy me that the dorsal fin of this, the northern species referred to, is strikingly larger than in the more southern Finbacks.

Appended is a sketch of one individual of several seen in Queen Charlotte Sound in February, 1865, which is a fair representation of them all. Those I have noticed about Fuca Straits seem to have the back fin modified in size between the extremely small found on Lower California and the one here represented.

Further investigation, which I hope to have the opportunity of before very long, may settle this question.

## VII. THE DOLPHIN FAMILY.

### *DELPHINIDÆ.*

In addition to the Whales which have been described as frequenting the coast, many species of Cetacea of the Dolphin family are also found. Those coming under our observation are known as the Bottlenose, Grampus, Black-fish, Killer, Cowfish, Right-whale Porpoise, Finback or common Porpoise, and Bay Porpoise. All these species are covered with a coating of fat or blubber, varying in thickness from half an inch upwards, according to their size and degree of fatness.

#### THE BAY PORPOISE.

##### *PHOCÆNA VOMERINA* Gill.

Proceed. Acad. Nat. Sci. Phila. 1865, p. 178.

The habits of this animal differ from those of the other species found in the open sea or along the coast. Their home seems to be in the discolored waters between the limits of the pure ocean element and the fresh rivers. They are rarely seen on either side of these boundaries. Our observation proves that they are found as far south as the Valle de Banderas Bay, about the mouths of the river Piginto, on the coast of Mexico, which is in lat.  $20^{\circ} 30'$ , and as far north as Columbia River, lat.  $46^{\circ} 16'$ . In the winter season they are seen off Astoria, and in Cathlamet Bay, twenty miles above; but during the spring and summer, when the river is fresh to its mouth, and in some instances for miles at sea, they leave the Columbia, following in the vein of mixed water. They are never found in schools, but occasionally six or eight may be seen scattered about, appearing on the surface alternately, singly or two or three at the same instant. They do not make those playful gambols and leaps that the other species do, their general habits being to make a quick turn as soon as appearing above water, apparently choosing the darkness below rather than the light above. It is not from shyness, however, for they are met with about roadsteads and harbors, among the shipping, and frequently play their odd turnings close about vessels under way or at their moorings. By night, when at anchor, we have known them to play about the vessel's rudder.

1869.]

Sometimes they are seen among the breakers on the bars which front harbor mouths, darting through or along the crest of the rollers as if excited into unusual action by the dashing waves surrounding them.

They feed on small fish, and are occasionally taken in the seines that are hauled about the shores of San Francisco Bay by the Italian fishermen.

#### BOTTLENOSE GRAMPUS.

The Bottlenose Grampus is probably the largest of the species of Cetaceans reckoned among the Dolphin or Porpoise family. Its color approaches nearer to brown than black. The fin on the back is comparatively small, angular in shape, with the longest side attached to the body, and placed much nearer the caudal fin than on other species. The name Bottlenose is said to have been given it by reason of the head resembling the upper portion and neck of a junk-bottle; if so, from our observation of them (which was many times, from the vessel's deck or masthead) in their different natural positions, the bottle must have been one with a very large but exceedingly short neck; still the comparison is not inappropriate. The Grampus has habits such as nearly preclude capture, and but little is known about its peculiarities. They are generally seen two or three together, "rounding" to "go down" as soon as coming to the top of the water and spouting, and when rising to the surface the next time may be beyond view. It is said they have been taken with a line upward of three hundred fathoms long.

The largest of the species are not less than twenty-five feet long, and otherwise of similar proportions with the Blackfish. The head appears to be intermediate between that of the Blackfish and Porpoise, having a short snout, or round-pointed beak.

I met with a related species on the coast of Lower California, in July and August.

An exception to this, however, occurred on the coast in July and August, 1856, between Cape St. Lucas and Cerros Island, at which time we saw large numbers of them going in schools, ten, twenty or thirty together, nearly all being of the largest growth, and their actions were a good imitation of a school of small sperm whales—spouting several times up, and only remaining down the usual time of sperm whales of their apparent size. Several fruitless trials were made to capture one. In two instances the harpoon was fastened effectually, and the consequence was that the animal immediately dived down with great velocity, each taking a line in its descent one hundred and fifty fathoms long almost before the boats' crews knew what they were about.

In March, 1857, off Panama Bay, on board the bark San Grande, we saw

ish-white. We have observed this species to have a wider range, to congregate in larger numbers and exhibit more activity than others of the Dolphin family. They are seen in numbers varying from a dozen up to many hundreds, tumbling over the surface of the sea, or making arching leaps, plunging again on the same curve, or darting high and falling diagonally sidewise upon the water with a spiteful splash.

When a brisk breeze is blowing they frequently play about the bow of a ship going at her utmost speed, the animal cutting across the bow and shooting ahead, or circling around the vessel, apparently sporting at ease.

They are found in every ocean, and are often seen in considerable numbers about the large bays and lagoons along this coast, that have no fresh water running into them. They abound more along coasts where small fish are found than in mid ocean, as they prey upon the smaller finny tribes, and to obtain them shoot swiftly through the water, seizing the object of pursuit with the slightest effort. Occasionally a large school of them will get into a shoal of fish, frightening them so much that they will dart around in all directions, taking no regular course to escape their pursuers, and finally get so bewildered as to lose nearly all control over their movements. At such times the Porpoise is manifestly the "sea swine," filling itself to repletion.

In perfectly calm weather they are sometimes seen huddled together on the glaring surface, their heads slightly raised, or reclining a little on their sides, as if resting from their constant activity; but such instances are not frequent. Generally they are seen in large numbers rushing over and through the undulating sea, exhibiting their active habits and propensity to roam over an unlimited extent of ocean.

#### RIGHT-WHALE PORPOISE.

The Right-whale Porpoise in form and habit is nearly the same as the Finback, except it has no fin on its back, and is rather more slender in proportion to its length. They are not seen in as large numbers, and are seldom found in shallow bays and lagoons. We have met with animals of this genus from about Cape Horn as far north as Behring Sea, showing plainly that their feeding grounds embrace the whole coasts of North and South America on the Pacific side, if no more.

#### THE COW-FISH.

A species of Porpoise, larger than the Finback or Right-whale kind, is known under the name of Cow-fish. It is longer also in proportion to its greatest girth, but its head is not as long. Its teeth are larger, less in number, and it differs in its color, being of a dull black, lightened a little on the belly. This description is based upon two momentary observations—the first at St. Bartolme Bay, in 1853, and the other in Ballena's Lagoon, in 1859. In its habits, likewise, as observed on the coasts of California, Mexico and Peru, it shows a striking difference. They are often remarked upon by whalers as a "mongrel breed," of doubtful character, often seen in company with Black-fish, sometimes with Porpoises, and occasionally with Humpbacks, when the latter are found in large numbers on an abundant feeding ground. They are met with likewise in the lagoons along the coast, sometimes singly, or in pairs or fives and sixes—rarely a larger number together—straggling about in a vagrant manner through the winding estuaries, subsisting on the fish that abound in them. At times they are seen moving lazily along under the shade of the mangroves that fringe the shores in many places, at other times lying about in listless attitudes among the plentiful supplies of food surrounding them, consisting of many varieties of the finny herds that swarm in those waters.

#### THE KILLER.

ORCA RECTIPINNA Cope.

The Killer is a peculiar species of Cetacean, that is found wherever the Ba-  
1869.]

Islands Whales resort, and about islands and rocks that are the breeding places of seals; consequently their feeding ground is as vast as that of the Hump-back.

Their average length is about twenty feet for the males and fifteen for the females, a long dorsal fin distinguishing them from all others of the Dolphin tribe, as well as the shape of their head, which is more pointed than that of the Blackfish, and with a still shorter beak than in the common Porpoise. Their color is black or black with streaks of white on the forward part of the sides from near the eye, extending as far as the end of the back fin in some cases. A greater portion of the belly is almost invariably white in the females. We never have seen but one of the species dead (a female, fifteen feet long, which answers to the above description). The back fin, on account of its extraordinary length, gives the fish a very singular appearance when moving along in its usual manner. It measures six feet or more with the larger males, who may always be known by the extremity of the fin turning over on one side as represented in the accompanying illustration. This protuberance vibrating in the air as the animal rolls to and fro or makes its tumbles over the waves, appears as though it was a great burden and required much effort for the animal to keep right side up. But from what we have observed in different latitudes we are inclined to the opinion that there must be more than one species of Killer on the Pacific coast. Those about the shores of California to all appearance are rather slender animals, with a long dorsal fin of dagger shape projecting from the back about one third of the distance between the extreme end of the head and the "flukes." The covering of fat on the one that was taken did not exceed three-fourths of an inch in average thickness, and was very white. The yield of oil was one and a half barrels, and nearly as clear as spring water.

Although diminutive in size compared with the different species of whales, they prey upon them all, except the Cachalot, the lips and tongues of the animals often affording them a bountiful repast. These Killers may be not inaptly styled the cannibals among the whale kind, being the only species that destroys individuals of their own race to afford them food. It is a most surprising sight to witness three or four Killers about a whale. The sight of them before making any attack seems to nearly paralyze the huge monster, who frequently remains nearly stationary, submitting to the attacks of its enemies on either hand, and making little if any resistance.

The mode of attack is to keep about the whale's head, seizing it by the lips, hauling it under water, and it is said to eat out the tongue. We once saw the attack made by three of these voracious animals on a "cow and calf," in a lagoon on the coast of Lower California. The whale was of the species known

however, we were so fortunate as to take one of them, as before mentioned, and on examining, to satisfy our curiosity about the character of its food, found that it consisted of young seals. At the time it was the sealing season, and the beaches about the island were covered with innumerable herds, and, although there were sealing parties about the shores from early dawn till dark, no one ever saw these savage animals molest the seals that were continually swimming about in large numbers.

Compared with other species of the Dolphin family, the Killers are not numerous. Their mating season, or time of gestation, is a matter of conjecture; probably in this respect they are similar to the Sperm Whale. We have met with them in mid winter about the Gulf of Georgia, and along the northern coast as far as Sitka, as often as at any other season of the year, showing plainly that they are not confined to warm latitudes, nor migrate from the colder climates during the rigorous months, and, in whatever region found, they seem to be always prowling for prey.

### THE SHORT-FINNED KILLER.

ORCA ATER Cope.

The Killers I have noticed in the Gulf of Georgia, about the northern end of Vancouver Island, and as far north as the Aleutian Islands, appear to have more white on the sides and are of a dull black on the back, the dorsal fin shorter and much wider at the base. Their habits, however, are the same, being almost invariably seen going along, with an undulating movement, three, four, six, or eight together. They are generally irregular in their course, and are much more of the time below than upon the surface of the water.

November 7th, 1868, we saw, in the Strait of Juan de Fuca, off Port Angeles, a number of Killers moving rapidly up the strait. We noticed one of the number peculiarly marked on the side with a white spot of shape as shown in the sketch. They were marked on the back also, with a brown spot approaching a crescent shape, just behind the dorsal fin; but we did not see them long enough to ascertain the shape with any degree of accuracy. The pectorals of the Killers seem to be farther from the head in proportion to their length of body than any others of the Dolphin family. This seems to be a provision of nature to facilitate their attacks on the whales, as when inserting the head between the lips of the Balæna, to eat out its tongue, these side fins of the former are not in the way.

I am fully convinced that there are at least two species of Killers on the coast between the latitudes of 20° and 60° north: one with a dorsal fin excessively long, narrow at the base, standing very erect; the other species with a shorter fin, somewhat curved, much broader and slanting backward.

### THE WHITEFISH.

BELUGA sp.?

My opportunities for observing the habits of the Whitefish, as termed by the American whalers, have been as follows: In the Okhotsk Sea, along the coast of Eastern Siberia, during the summer of 1862; in Plover Bay, lat. 64° 26' N. long. 173° 07' W., September, 1865, and in the same place and month of 1866; in Norton Sound Sept., 1865.

Their habits are similar to those of the Blackfish in many respects, being seen in schools of various but usually less numbers than the former. When pursued they appear to be wild and to avoid the boats. One striking peculiarity I observed was their going along *one after the other in a sort of train*, coming to the surface and spouting irregularly, showing but little of the body above water. It was unusual to see more than two or three abreast, undulating through the water, at the same time. They often make a noise when coming to the surface that may be compared to the faint low of an ox, but the 1869.]

strain not so prolonged. Sometimes they gambol about vessels as do porpoises. We know of only one instance, however, which was in Tchanter Bay, during calm weather, in August, 1862. All our efforts to capture one proved fruitless. We learned from the natives that they were less shy about the mouths of rivers, where they resort frequently during the warm season, and even ascend into fresh water where the depths permit. Only one chance of getting a view of the animal was in the water close alongside the ship, and it answered to the description of those found in the Arctic Ocean, the head and neck appearing much smaller in proportion than that of any other species of the Dolphin family. Their length may average ten feet, color white or yellowish white.

### THE BLACKFISH.

#### GLOBIOCEPHALUS SCAMMONII Cope.

The Blackfish is found wherever sperm whales are, but in many instances they congregate in much larger numbers, and are nearer to the coast than the regular feeding grounds of the latter.

Although subsisting almost entirely on the same kind of food, the "squid," still, at times, when they visit bays or lagoons, they prey upon small fish found there. In Magdalena Bay we have seen them in small schools, appearing as much at home miles from sea as the Porpoise or Cowfish.

They are seen in schools of from ten or twenty to hundreds, going along with less of the rising and falling movement than the Porpoise, and usually spouting eight or ten times before "going down." If moving quickly much of the head and body is exposed. When seen by whalers in this wise they call it going "eye out." In low latitudes, during perfectly calm weather, it is not unfrequent to find them lying quite still, huddled together promiscuously, making no spout, and seemingly taking a rest.

The 14th December, 1862, on the coast of Lower California, in lat. 31°, land ten miles off, a school of Blackfish were "raised." We lowered the boats and gave chase; three were taken. The largest was measured accurately, and the dimensions were as follows:

	Ft.	In.
Length .....	15	6
Depth of body.....	3	6
Circumference of body.....	8	9
Breadth of flukes.....	3	6
Depth of flukes.....	1	0
Distance from end of head to spoutholes.....	1	6
"                    "                    eye .. ..	1	4
"                    "                    dorsal fin.....	4	6

The breadth of the head where cut from the body—just forward of the side fins—was twenty-two inches. From all we can learn of their breeding habits, they bring forth their young at any time, or in any part of the ocean, as necessity may require. Off the Gulf of Dulce, coast of Guatemala, in February, 1853, a calf taken from one was three feet long, the mother measuring thirteen feet. In the same school it was taken from we saw several young ones apparently about the same size as that above named, hence doubtless this foetus, had it not been disturbed, would have soon played in its native element.

The Blackfish is taken for its oil, which is however much inferior to sperm, and the yield is small compared with its size, which may be calculated as varying from ten to twenty-five feet in length, and the production of oil from half a barrel to ten, the coating of fat or blubber varying in thickness from one to three inches, and nearly white.

The flesh is like coarse beef, and after being exposed to the air for a few days, then properly cooked, is by no means unsavory food, and is often used by whalers as a substitute for the fresh meat of land animals. The same may be said of the different species of Porpoises.

Formerly Blackfish were found in large numbers on the coast of Lower California, particularly about Cape St. Lucas and up the Gulf, but, probably from the same cause as made mention concerning Sperm Whales, these grounds are now but little frequented by them.

#### *The Pursuit and Killing.*

Although the Blackfish is taken for its oil, it is not an object of pursuit by the whaler, as is the Balæna and Cachalot. Sperm whalers do not lower their boats for Blackfish when on Sperm Whale ground, unless the day is far spent or there is little prospect of "seeing whales."

The northern or polar whaleships pay but little attention to them, except it may be when passing the time "between seasons," cruising within or about the tropics. Occasionally a small vessel is fitted out for blackfishing and sperm whaling, carrying a proportionately limited crew, thereby making blackfishing profitable.

When a ship's boats are lowered for blackfish the chase begins as for other whales, although the masters of many ships have their boats all ready, and run just ahead of or into the school with the ship before lowering, by which means they are generally so much frightened or "gallied," that they "bring to," that is, stop for a short time, or move but slowly in all directions, giving the boats, which are instantly lowered, a good chance to "get fast." The harpoon frequently kills the fish; if not, a few darts with the hand lance dispatches it. As soon as dead they almost invariably sink; therefore, if the ship is close to, the fish is towed to the vessel at once; but if a considerable distance off it is either made fast to the loggerhead at the stern of the boat, or a buoy is tied to it and left, the boats continuing the chase. In this way quite a number are captured from one school.

Their favorite resorts along the coasts of North and South America, on the Pacific side, are off Guatemala, Equador and Peru.

### VIII. *PHYSETERIDÆ.*

#### THE SPERM WHALE.

##### PHYSETER MACROCEPHALUS Linn.

The Sperm Whale in form and habits is in many respects the opposite of the Balæna. Its color is a dull black, and in some individuals, particularly the old males, approaches nearer to gray.

Its principal food is "squid," the flesh of which is tender, destitute of bones, and as white as that of the sun-fish. "The upper portion of the head embraces a large cavity, separated and covered by cartilages, and filled with an  
1869.]

oil which becomes fixed as it cools, and is known under the name of spermaceti. The body yields sperm oil. The substance known under the name of ambergris is a concretion found in the intestines of Sperm Whales."

The Sperm Whale is found usually in the deep open sea, or, as whalers term it, "off soundings," but many instances are known of their being seen in large numbers, and captures have been made on soundings. This has been the case to our knowledge off St. Bartolme Bay and Ballenas Bay, on the Lower California coast, the depth of water at these places varying from forty to eighty fathoms.

Many have the impression that the Sperm Whale is found but rarely out of the limits of tropical or temperate waters, but we have known of the larger class being often taken as far south as  $50^{\circ}$  of latitude, both in the Pacific and Atlantic, and as far north in the Pacific as Cape Ommanay, which is in latitude  $56^{\circ} 12'$ .

The Sperm Whale is usually found in schools numbering from fifteen up to hundreds, females with their young predominating; sometimes the large males are found alone, at other times in schools, either alone or in company. The sperm whale is very regular in its spoutings, the volume of vapor being ejected forward in one column at nearly a right angle with the body, and the time it remains under water after it has made its habitual number of blows is marked with great uniformity also. The spout-hole is situated at a point formed by the superior and anterior surfaces of its head, a few inches on the left side.

The one referred to as being taken off the Galapagos Islands in 1853, spouted (or blowed) fifty-five times while on the surface (ten minutes), and when he descended to the depths below, turned his flukes a few feet out of water and was not visible again for fifty-five minutes; at the expiration of which time he was seen as before, and when his spoutings were out, which occurred at regular intervals, he again disappeared in the same manner. This whale was pursued from eleven o'clock A. M. to four P. M., during which time he did not deviate in his course, and the number of respirations at each rising and the time of remaining under water after turning flukes were alike.

The smaller and younger whales spout a less number of times, remain under water a shorter period, and are not quite so regular in their habits. This class of them usually remain above water one-fourth or one-fifth of the time, making from thirty to forty spouts at each rising, and remain under water about twenty minutes.

But when the Cachalot becomes alarmed, or is sporting on the ocean, it exhibits widely different actions, sometimes thrashing the water with its flukes

and sometimes descending below the surface then giving itself

brings forth its young in any part of the ocean it may be in, seldom having more than one at a time, never more than two.

Formerly this species was found in great numbers along the coast of Upper California. The ships cruising for them kept in a belt of water extending about one hundred miles from the land and closing in with the shore.

The frequent passing of steamers and the large increase in the number of sailing vessels on the coast seems to have driven them from these feeding grounds, and consequently at the present time this old cruising ground is nearly abandoned. In their capture the bomb-gun and lance is used by American whalers in addition to the ordinary hand harpoon and lance. Greene's gun is much used by English colonial whalers in addition to the old method.

## IX. PINNEPEDIA.—THE SEA-ELEPHANT.

*MACRORHINUS ANGUSTIROSTRIS*, Gill.

Proceedings of the Essex Institute v, 1866.

Proceed. Chicago Ac. Nat. Sci. ? loc.

A species of seal was in former years found along the coast from Cape St. Lazarus to Point Reyes, herding on sandy or shingle beaches in great numbers, and were known as the sea elephant. This animal, in form, resembles the common seals, only materially differing in its mammoth proportions. Frequently those unacquainted have mistaken "rookeries" of sea-lions for elephants.

The extreme length of the oldest males will average fourteen or fifteen feet; the longest we have ever seen measured twenty-two feet from tip to tip, but frequently individuals have been met with that gave seventeen to eighteen feet from extreme end of trunk to that of posterior flippers. Its color is a light brown, when the hair is grown to full length; but immediately after "shedding" it becomes of a leaden color, similar to the land elephant. The hair on the body is very short and thin; about the under side of the neck in the oldest males, the animal appears to undergo a change with age, the hair falls off, the skin thickens and becomes wrinkled, the furrows crossing each other, producing a checkered surface, and sometimes the throat is more or less marked with white spots. Its proboscis extends from opposite the angle of the mouth forward (in the large males) about fifteen inches when the animal is in a state of quietude, and the upper surface appears ridgy; but when it makes an excited expiration the trunk becomes more elongated and the ridges nearly disappear. The average thickness of the skin that covers the body is fully equal to that of the largest bullock. The mouth is furnished with teeth similar to those of the Sea-Lion, the lower and largest canines being from four to five inches long, the exterior portion conical, and presenting a smooth surface, the part imbedded in the jaw slightly curved and ridgy; the whole tooth is nearly solid, a small cavity only appearing at the lower end. The females average ten feet between extremities and are destitute of the proboscis, the nose being like the seals, except that it projects considerably ~~over~~ over the mouth. The canine teeth are shorter, smoother below the sockets, larger at the base and hollow nearly to the upper point. The sailors on one voyage not having a supply of pipes, made them of cow-elephants teeth and the quills or leg-bones of the pelican; the former furnishing the bowls and the latter the stems.

Our observations on the Sea-elephant show that they were found in much larger numbers from February to June than during the other months of the year, but more or less were on shore at all seasons upon their favorite beaches, which were about Santa Barbara, Cerros, Guadalupe, St. Bonites, Navidad, St. Roque and Ascension islands, and a few of the most inaccessible points on the main land between Ascension and Cerros. The first seen of them would be coming up out of the water near the beach, then crawling up

1869.]

by degrees, frequently reclining as if to sleep, then again moving up or along the shore, appearing not content with their last resting place. In this manner they would ascend ravines or low intervals half a mile or more. They are not so active on shore as the seals, but when excited to inordinate exertion their motions are quick, the whole body quivers in their semi-vaulting, crawling gait, and the animal at such times manifests great fatigue; notwithstanding its unwieldiness we have sometimes found them on broken and elevated ground fifty or sixty feet above the sea. The principal seasons of their coming to shore are when they are about to shed their coats, and the females to bring forth their young (which is one at a time, rarely two), and the mating season. These seasons for "hauling up," as it is termed, are more marked in southern latitudes, as I have learned from ship masters who have taken seals about Kerguelen's Land, the Crozets and Hurdis Islands. The different periods were known as the pupping cow season, the brown cow, bulls and cows, and march bull seasons. But in the species of our coast, either from the influence of climate, or some other cause, we have noticed young pups with their mothers at quite the opposite months. The time of gestation is supposed to be three-fourths of the year. The continual hunting of these animals may have possibly driven them to irregularities. The most marked season, however, that we could discover was that of the matured males, which shed their coats later than the younger ones, and the females; still among the largest herd of these gregarious creatures taken on Sta. Barbara Island, in June 1852, were several cows\* with pups apparently but a few days old. When they come on shore for the purpose of "shedding," if not disturbed, they remain out of the water till the old hair falls off; by the time this change comes about, the animals are supposed to lose at least half their fat. In the stomach of the Sea-elephant a few pebbles are found, which has given rise to the saying that "they take in ballast before going down," (returning to the sea). On warm sunny days we have watched them come up singly on a smooth beach and burrow in the dry sand, throwing the loose particles that collected about the fore limbs over their backs, nearly covering themselves from view. The largest number we ever found in one herd was one hundred and sixty five, which lay promiscuously along the beach or up the ravine near by. The mode adopted to capture them is to land in front of the "rookery," getting between them and the water, with clubs and lances in hand, then raising a loud noise and moving slowly toward them, they retreat back, appearing in a great state of alarm. Occasionally an overgrown male will give battle, or attempt to escape, but a ball from a musket through his brain despatches him, or some one with a lance checks his progress by thrusting it into the roof of his mouth, which causes the animal to throw back its head and fall on its back, or it may while



ing begins. First, with a large knife the skin is ripped on the upper side of the body its whole length, then skinned down as far as practicable without rolling it over. The coating of fat that lays between the skin and the flesh, being from one to seven inches in thickness, according to the size and condition of the animal, is cut off into "horse pieces" about eight inches wide by twelve to fifteen long, and a puncture made in each piece large enough to pass a rope through. After *flensing* the upper side the animal is rolled over and cut all around as above described. Then the horse pieces are strung on a raft-rope,\* which is taken to the edge of the surf and a long line made fast to it, the end being thrown to a boat that lies just outside of the rollers. They are thus hauled through the breakers and towed to the vessel, where they are tried out on board.

The oil produced is superior to whale oil for lubricating purposes. The individual yield may be less than a barrel with the smaller males and females, but the larger males make from three to seven. Owing to the continual pursuit of these animals they have become nearly, if not quite, extinct, or have fled to some isolated, unknown points for security. The latter conjecture, however, seems hardly probable, for the Sea-elephant, it is said, has never been found in the north Pacific, except on the coasts of the Californias.

### Notice of some extinct VERTEBRATES from Wyoming and Dakota.

BY JOSEPH LEIDY, M. D.

#### 1. OMOMYS CARTERI.

On several occasions, Mr. J. Van A. Carter, of Fort Bridger, Wyoming, sent to me a number of fossils consisting of small blackened fragments of bones, together with casts of fresh water shells, obtained from a tertiary formation. In one of his letters, Mr. Carter remarks that the country in his vicinity is covered with buttes, composed mostly of a gray sandstone, easily worn by the weather, wind and snow. Particular strata of a greenish gray cast contain the fossils.

Portions of rock accompanying the fossils consist of a crumbly, greenish gray, granular material, with few imbedded fragments of soft and more homogeneous rock. Some of the specimens contain multitudes of minute whitish concretions having a concentric arrangement. The fossil shell casts for the most part consist of what appear to be a species of *Melania* and of *Planorbis*. The bone fragments consist of remains of teleost fishes but mainly of reptiles, generally too imperfect for specific identification. The reptilian remains, mostly of turtles, indicate several species of *Trionyx*, *Emys*, etc.; a Crocodilian is also represented.

Among the fossil bones from the same formation, Mr. Carter sent me a portion of the cranium of a small mammal reduced to indeterminate fragments except a few pieces, which indicated apparently the skull of a carnivorous animal about the size and general form of that of the Mink. Fragments of the parietals and contiguous bones adherent to a portion of matrix, exhibit a long, low sagittal crest separating a capacious pair of temporal fossæ with surfaces almost as convex as in the Mink. A portion of the supra-occipital and condyles, adherent to another portion of matrix, enclose a foramen four lines in transverse diameter.

As Dr. Carter informed me that he had obtained the fossil cranium from its position in the rock, at my solicitation he examined the locality for other portions of the skull, and had the good luck to discover the greater part of the right ramus of the lower jaw, apparently of the same animal. This specimen indicates an insectivorous mammal, probably belonging to the family of the hedge-hogs. Among living insectivora, described and figured by DeBlainville,

---

\* A rope three fathoms long, with an eye spliced in one end.

Gervais, Peters, Mivart, and others, the jaw fragment approaches most nearly in size and form the corresponding portion in the representations of *Tupaia ferruginea*, of Java and neighboring isles. It likewise nearly resembles in size and form the corresponding portion of a fossil jaw, found in a miocene formation of Sansan, France, and referred to an insectivorous animal with the name of *Galerix viveroides*. The extremities of the ramus are lost, and the remaining portion contains four molar teeth. The depth of the jaw below the position of the latter measures about two lines and is nearly uniform. The base is but slightly convex fore and aft, below the position of the teeth. Back of these to the broken end of the specimen it is slightly concave. The mental foramen is below the position of the second premolar, and the symphyseal articulation reached as far back as the third. The masseteric impression is well marked, and well defined about two lines back of the position of the second true molar.

Seven molar teeth, in an unbroken series, appear to have occupied the side of the jaw. Four appear to have been double-fanged premolars with laterally compressed conical crowns. Only the third and fourth of the latter are preserved. The alveoli of the second are retained, and also the inner side of what appears to be a pair for the first premolar.

The last true molar, which has lost its crown in the specimen, appears to have been a double fanged tooth, constructed like those in advance.

The teeth in the specimen from the third premolar to the second true molar successively, and after the former, gradually decline in height or prominence.

The third and fourth premolars nearly resemble in general form and proportions the second and third premolars of the Opossums. The true molars are constructed on the same general pattern as those of the genera *Sorex*, *Erinaceus*, *Gymnura*, *Potomogale*, *Galeopithecus*, and the Opossums. All the teeth are provided externally with a basal cingulum or ridge, nowhere elevated into points or cusps.

The crown of the third premolar, more prominent than in any other tooth, is triangular, longer than broad, pointed, and thicker posteriorly. Its anterior border is acute and slightly convex in the length, the posterior outline, formed by the back part of the outer convex surface, is slightly concave. The inner surface, narrower than the outer, presents at its fore part below, a narrow ledge feebly continuous forward as an element of the basal cingulum. This is best developed as a talon at the back of the crown, and least externally and postero-internally. The outer surface of the crown, convex transversely, is continuous posteriorly.

The fourth premolar has nearly the same form as the preceding tooth, but its crown is lower and wider. The basal cingulum is rather better developed

The space occupied by the molar series was about  $6\frac{1}{2}$  lines. The length of the crown of the third premolar is one and one-fifth lines; the breadth 1 line. Length of crown of second premolar five-sixths of a line, breadth one and one-fifth lines. Breadth of first true molars  $1\frac{1}{2}$  lines.

Unlike the corresponding part of any other insectivorous animal known to me, I have referred the jaw fragment to a new genus, and have dedicated the species to its discoverer, with the name of *Omomys Carteri*.

## 2. NANOHYUS PORCINUS.

In the expedition of Dr. F. V. Hayden, in the summer of 1866, to the Mauvaises Terres of White River, Dakota, among the fossil vertebrate remains previously noticed or described, he discovered a fragment of the left ramus of the lower jaw of a small mammal, supposed to be nearly allied, if not belonging to the suiline family.

The teeth in the fragment consist of the last temporary molar; the succeeding two permanent molars in functional position, and the anterior portion of the third molar partially protruded. The interior of the jaw beneath the temporary molar is occupied by the crown of the last premolar, which, judging from the appearance of the exposed outer part, has the same form and size as the molars behind.

The temporary molar is inserted by a pair of widely separated fangs, and its crown presents the usual greater breadth than in the succeeding pair of those of the teeth behind, as in pachyderms generally. The crown is trilobate externally and internally, and this condition probably corresponds with three constituent pairs of lobes, the distinction of which is for the most part obliterated by wearing. The median division of the crown is largest, and that in advance is the smallest. The abraded summit of the former presents an irregularly transverse quadrate surface of exposed dentine continuous with a smaller subreniform tract upon the anterior division. The posterior division of the crown still exhibits the distinction of a transverse pair of lobes, of which the outer one is much the larger. This presents on its abraded summit a crescentoid surface of exposed dentine, and the inner one a minute circular islet of the same substance, and both are considerably below the level of the worn surfaces of the divisions of the crown in front.

The two permanent true molars preserved in the specimen are alike in form and size, and the anterior portion of the last molar agrees in character with the corresponding portion of the teeth in advance.

The crown of the first and second true molars is composed of two transverse pairs of conical lobes of which the anterior are about a third higher than the posterior, and are separated from them by a deep transverse valley. The inner and outer lobes are separated by a valley almost half the depth of the former, closed at the fore and back part of the crown by a small tubercle. The front tubercle is most conspicuous, and receives a feeble offset or ridge from the antero-external lobe. A similar offset from the postero-external lobe ends in the middle of the transverse valley of the crown. A basal ridge exists nowhere except at the fore part of the crown, where it is most conspicuous externally and is there associated with the tubercle closing the front of the fore and aft valley of the tooth.

A minute circular islet of exposed dentine occupies the summits of the anterior lobes of the crown of the first true molar.

The breadth of the crown of the last temporary molar is  $2\frac{1}{2}$  lines. The breadth of the crown of the second unworn permanent true molar is  $1\frac{3}{4}$  lines, and its height at the anterior division is the same.

The depth of the jaw fragment below the first permanent true molar is one fourth of an inch. The base is moderately convex fore and aft.

Though I have found it difficult to ascertain, by comparison with figures, how far the fossil described differs from the corresponding portion of other known animals, it nevertheless appears to me to do so sufficiently to refer it to a distinct genus and species, for which I have proposed the name of *Nanohyus porcinus*.

1869.]

3. *TRIONYX GUTTATUS*.

Remains apparently of the same species of *Trionyx* as that indicated by the small fragments above mentioned, were discovered by Dr. F. V. Hayden in a Tertiary deposit at Church Buttes, near Fort Bridger, Wyoming. The most characteristic specimen obtained by Dr. Hayden, during a geological survey on account of the Commissioners of the General Land Office at Washington, belongs to the Geological Cabinet of that Office, and has been submitted to my inspection by its Secretary, Dr. A. R. Roessler.

The specimen consists of the portion of a carapace adherent to a homogeneous, greenish gray, argillaceous rock. It retains the third to the seventh vertebral plates inclusively entire, with part of the second one; and the 6th and 7th right costal plates, together with parts of those of the second to the fifth inclusively of the same side, and smaller portions of several of the same plates of the left side.

The plates are for the most part marked by distinct or separate circular pittings, which only run into one another more or less at the outer third of the costal plates.

The carapace appears to have been longer than broad, and has approximated about 14 inches in length by about a foot in breadth. The fourth and fifth costal plates appear to have been unusually expanded or widened outwardly. The sixth costal plates conjoin in the median line, though their inner angles are separated by the sixth and seventh vertebral plates. The breadth of the last costal plate is within half an inch of its length.

The third vertebral plate is six-sided or coffin-shaped in outline. It measures 23 lines long, 5 lines wide at the fore part, gradually widening to a little over an inch, and then rapidly narrowing to 8 lines at its back part.

The second vertebral plate appears to have had the same form and a somewhat greater size.

The fourth vertebral plate in the specimen is rather irregular at the sides, and the right posterior angle is twice as long as on the left side. Its length is  $20\frac{1}{2}$  lines; its width where greatest posteriorly is  $10\frac{1}{2}$  lines.

The fifth vertebral plate is smaller than the former and has its lateral borders approaching in a curve at the hinder extremity. Its length is  $19\frac{1}{2}$  lines; its anterior border is 7 lines wide, and its greatest breadth is  $8\frac{1}{2}$  lines.

The sixth vertebral plate is cordiform or five-sided in outline, and is almost 10 lines in length and breadth.

The seventh vertebral plate is lozenge-shaped and occupies the interval between the approximate angles of the 6th and 7th pairs of costal plates. It is  $7\frac{1}{2}$  lines long and 11 lines wide.

ward about a fourth of an inch, and ends in a transverse truncate border, which in the entire sternum would measure two inches in width. The position of the ento-sternal plate, of the usual form, at the suture of the epi- and hyo-sternal plates would measure 22 lines in breadth. The depth of the episternal to the ento-sternal is 11 lines; the breadth at the posterior suture 14 lines. In the specimen near the median suture there exists a groove, apparently indicating a long narrow scute intervening between the gular scutes, but not reaching the anterior border of the sternum within four lines. This last mark may perhaps be an anomalous one.

#### 5. CROCODILUS APTUS.

Dr. A. R. Roessler, in charge of the Geological Cabinet of the General Land Office, Washington, has submitted to my inspection a specimen from the collection consisting of a cervical vertebra of a Crocodile. The specimen was found by Col. John H. Knight, U. S. A., near South Bitter Creek, where it crosses the stage route about 70 miles west of the summit of the Rocky Mountains, in western Wyoming. It is thoroughly petrified, and the bone appears to have been of mature age. It has lost the greater part of the neural arch with the dependent processes, but is otherwise perfect. It belonged to an animal about the size of the Mississippi Alligator, and the bone bears a near resemblance with the corresponding sixth or seventh cervical vertebra of that species. The hypapophysis has the same character, projecting obliquely from the fore part of the centrum, but the latter is less carinated back of the process.

Length of centrum in its axis 16 lines; height and breadth in front 14 lines. Length of hypapophysis below the anterior articular concavity of the centrum 5 lines.

Probably the vertebra may belong to the same species as less characteristic fragments of bone, found by Mr. Carter, near Fort Bridger, in the same territory.

### Descriptions of new CRINOIDEA and ECHINOIDEA, from the Carboniferous rocks of the Western States, with a note on the Genus ONYCHASTER.

BY F. B. MEEK AND A. H. WORTHEN,  
Of the Illinois State Geological Survey.

Genus SYNBATHOCRINUS, Phillips, 1836.

SYNBATHOCRINUS WACHSMUTHI, M. and W.

Body below the top of the first radial pieces nearly semi-globose, or approaching semi-oval, being about twice as wide as high, and rounding to the column below. Base forming one-third to nearly one-half the height, somewhat basin shaped, and obscurely pentagonal in outline as seen from below; basal pieces, with the two larger divisions wider than high, and hexagonal in outline, and the smaller about as wide as high, and pentagonal in form. First radial pieces two-thirds to three-fourths as high as wide, with a general quadrangular outline, but two of those on the anal side, have each one of the superior lateral angles slightly truncated to form a notch for the reception of the first anal piece, so as to give each an additional angle. Second radial pieces of nearly the same size as the first, but not tapering upward as much as the first do downward, quadrangular in outline, and generally about three-fourths as long as wide. First anal piece about half as wide as long, pentagonal in form and equaling the length of the second radial pieces; second anal piece nearly half as long as the first, on the truncated upper end of which it rests; trigonal in outline, the upper angle being acute.

Arms very long and very gradually tapering, angular along the middle of the dorsal side, and each composed of more than thirty quadrangular pieces, 1869.]

that are somewhat wider than long, and provided with a very deep ambulacral furrow within. Minute ambulacral pieces extending up the furrows of the arms, from five to seven to each arm-piece, in each row, the two rows arching over the deep furrow. Probosciform ventral tube very long, slender, cylindrical, and composed of apparently not more than two or three vertical ranges of oblong curved pieces, about half as long as those of the arms.

Column comparatively rather stout, rounded, and composed near the base of more or less irregular pieces, gradually becoming thicker farther down, and all pierced by a small rounded or subpentagonal central canal.

Surface, when well preserved, showing under a strong magnifier minute granulations, with a tendency to run together into a kind of vermicular style of marking.

Height of body of a medium sized specimen, to the top of the first radial pieces, 0.16 inch; breadth 0.28 inch; height to top of second radial pieces, 0.30 inch. Length of arms, about 3 inches; breadth of same at the base, 0.15 inch. Thickness of column, 0.10 inch.

This species will be at once distinguished from all the others known to us, by having its body obtusely rounding under to the column below, instead of expanding upward from the same, with straight or concave sides. By this character alone of its body, exclusive of the second radials, when found detached, it can be readily distinguished from *S. dentatus*, Owen and Shumard, as well as from *S. Wortheni* and *S. papillatus*, Hall.

We have elsewhere noticed the occurrence of a long pipe-stem-like ventral tube in this genus, and a double series of minute ambulacral pieces extending up, and apparently arching over, the ambulacral furrow of each arm.\* These characters were first observed in this species, in which the ventral tube seems to be nearly as long as the arms. We have also seen indications of the same characters in *S. Wortheni*, and fragments of other undetermined species, and hence have little doubt that they occur in all the species of the genus, when well preserved. There is perhaps scarcely any other type of all the various genera of Crinoids, in which one would less expect to find such an elongated ventral tube, than in this.

*Locality and Position.* Upper division of the Burlington group, Burlington, Iowa. Lower Carboniferous. No. 235, of Mr. Wachsmuth's collection.

#### SYMBATHOCRINUS BREVIS, M. and W.

Body small, expanding rather rapidly, with nearly straight sides from the base to the top of the first radial pieces, thence contracting very slightly to the top of the second radials. Form and arrangement of the body pieces very

more inclined to round in to the column below, but not near so much so as in the last described species, from which it also differs in having much shorter arms.

*Locality and Position.* Lower Burlington beds, Burlington, Iowa. Lower Carboniferous. No. 336 of Mr. Wachsmuth's collection.

Genus DICHOCRINUS, Münster, 1839.

DICHOCRINUS LINEATUS, M. and W.

Body ovoid-subglobose, about as wide as long, not rounded below, but abruptly tapering to the column; widest near the middle, and but slightly contracted above. Base forming very nearly half the height, and expanding rapidly, so as nearly to equal, at the top, the greatest breadth of the body; margins faintly sinuous for the reception of the next range of pieces; sutures a little furrowed, but anchylosed. Radial pieces quadrangular, generally nearly or quite as wide as long; sinus above, for the reception of the second radials, shallow, rounded, and equaling about half the breadth of the upper margin, marked with fine radiating striæ at the outer margin. Anal piece as wide below as the first radials, but narrower above, and slightly shorter; sub-pentagonal in form, being but very obtusely angular in the middle below. (Succeeding parts unknown.)

Surface ornamented with numerous sharply elevated lines, slightly less than the furrows between. Of these lines, on the base, a part near each lateral margin run parallel to the same; while other series farther from the margins, although parallel with each other, on each side of the middle, run obliquely so as to connect with the lateral ones, and with each other, along the middle, in such a manner as to form three divaricating series on each piece: near the upper margins there are also traces of a few very fine crowded striæ running parallel to the same. On the first radial and anal plates there are also a few fine transverse striæ, near and parallel to the lower margins; while on a triangular central space, with its most acute angle terminating near the middle of the top, there are vertical or slightly converging striæ of the same size as the divaricating series on the base; and on each upper lateral space, on each side, another series runs up and down, parallel to the lateral margins. Column rather small, round, and provided with a very minute central perforation.

Height of body to top of first radials, 0.65 inch; breadth, 0.66 inch; height of base about 0.30 inch.

This species seems to be somewhat intermediate in its characters between *D. ovatus* and *D. striatus*, of Owen and Shumard. From the first it differs in having distinct, sharply defined, continuous lines on the body plates, instead of merely rows of depressed granules; and these lines also run differently on the basal pieces from the rows of granules on that part of *D. ovatus*, which are described as forming a series of hexagons, one within the other, instead of forming three series of triangles, as the lines on our species show a tendency to do. The lines are also as well defined on the radial and anal pieces of our species as on the base, while the surface of these parts of *D. ovatus* is described as being merely "corrugated."

In having continuous, well defined, raised lines, it agrees more nearly with *D. striatus*, of Owen and Shumard; but it is easily distinguished from that species by having these lines very much finer and more crowded, as well as greatly more numerous, there being about ten of them in the space of 0.20 inch, which only includes four or five of those on *D. striatus*.

*Locality and Position.* Lower Burlington beds, Burlington, Iowa. Lower Carboniferous. Mr. Wachsmuth's collection.

DICHOCRINUS PISUM, M. and W.

Body small, somewhat cup-shaped, approaching sub-globose, rather depressed or flattened below, and from one-fourth to one-third longer than wide, 1869.]

slightly contracted at the top. Base nearly flat, or presenting a shallow dish-shape, sub-circular outline; facet for attachment of the column very small. First radial plates generally slightly longer than wide, and nearly quadrangular in form, comparatively moderately thick; sinus in the upper margin of each, for the reception of the second radials, very shallow, and about half as wide as the upper margin. Anal plate wider below than any of the first radials, but narrowing upward; provided with a very obscure angle at the middle of the under side, so as to present a sub-pentagonal outline. (Arms and vail unknown.)

Surface ornamented with comparatively strong, rounded costæ, wider than the furrows between. On the base these are arranged in three divergating series, the lateral costæ being parallel to the lateral margins, and the divergence upward. On the radial and anal plates there are 7 or 8 of these costæ which run nearly vertically and parallel, the lateral ones, however, converging above, so as to leave small triangular spaces on the superior lateral corners, on which there are a few short costæ not properly connected with the others.

Height of body, 0.30 inch; breadth, 0.37 inch. Costæ on radial plates, six or seven in the space of 0.20 inch.

In the coarseness of its costæ this species is nearest like *D. striatus*, of Owen and Shumard, but it differs in having its costæ rather smaller, more rounded and separated by furrows, distinctly smaller than the costæ themselves, which are also without the numerous little asperities seen on those of *D. striatus*. It is also a smaller, shorter species, with a much more depressed or nearly flat base.

*Locality and Position.* Upper division of the Burlington group at Burlington, Iowa. Mr. Wachsmuth's collection.

#### Genus ERISOCRINUS, M. and W. 1865.

This genus was originally proposed by us for the reception of two very similar forms, one of which, from the upper part of the Coal-Measures of Illinois, we called *E. typus*, and the other, from the same horizon in Nebraska, we called *E. Nebrascensis*. The specimens then known consisted only of the body up to the summit of the first radials. This part of these forms is sub-hemispherical in outline, being rounded below, and evenly truncated above, with five minute, or very small basal pieces, surrounded by, and alternating with, somewhat larger subradials, which in their turn alternate with, and support, five larger, thick first radials, with articulating facets occupying their entire breadth above for the reception of the next range of radials. These radials being in contact with each other all around, leave no spaces for anal

ever, we thought it desirable to change the specific name of our species *typus*, it not being the type of the genus *Philocrinus*.

We were led to regard our species as not being generally distinct from *Philocrinus*, because they agree exactly in all their known generic characters, unless the lower range of pieces shown in the figure of *Philocrinus* really are the basal pieces, which would make that genus without subradial pieces. As the typical specimen, however, seems, from the figure, to be a little defective at the lower extremity, and the lowest range of pieces represented, if really prolonged to the bottom of the body, would have to present a very remarkably elongate cuneiform outline, we were strongly impressed with the probability of there being another smaller series of true basal pieces below the lowest range represented (but not visible in consequence of the condition of the specimen), especially as these forms appear to agree so nearly in other respects. If so, there would be no generic differences between *Philocrinus* and *Erisocrinus*, and the American species would have to stand under the former name. If *Philocrinus*, however, really has no subradial pieces, then, of course, *Erisocrinus* must be an entirely distinct genus. Until all doubts on this point, however, can be removed, we finally concluded to retain our name *Erisocrinus*.

The close similarity of the body of some species of this genus, and that of another allied form, found in the upper members of the Coal-Measures of Nebraska, to the corresponding parts of the genus *Encrinurus*, and their wide difference from all the then known Lower Carboniferous Crinoids of America, have been appealed to as facts sustaining an opinion, maintained by some, that these Nebraska beds belong to the age of the Permian of Europe, instead of to the Coal Measures. The fact, however, that we now have the species of this genus described in this paper, from the lower part of the *lower* Carboniferous or Mountain Limestone at Burlington, ought, we should think, to be sufficient evidence that no such conclusions can be properly based on this type of fossils.

#### ERISOCRINUS ANTIQUUS, M. and W.

Body small, much depressed, somewhat basin shaped, or very rapidly expanding from the base to the summit of the first radial pieces, at the connections of which it is very faintly sinuous around the margins, as seen from below. Base small, subpentagonal, almost entirely covered by the round, flat facet for the attachment of the column; basal pieces exposing very small pentagonal surfaces, three or four times as wide as long. Subradial pieces each about one-half to two-thirds as large as the whole base, all uniformly pentagonal (there being no visible angle at the middle of the base), and with the upper sloping sides each about twice the length of the lateral margins. First radial pieces about twice as large as the subradials, half as long as wide, and all equally pentagonal, with the lateral and inferior sloping edges of nearly equal length, and the straight, upper truncated side equaling the entire breadth; articulating upper edge very thick, deeply notched at the middle on the inner edge, and provided with the usual transverse ridge and furrows. Second radials as wide as the first, and about three-fourths as long as wide, angular in the middle on the dorsal side, and constricted on each lateral margin; pentagonal in form, and supporting on their superior sloping sides the first arm pieces, which are quadrangular, slightly constricted on each side, and a little wider than long; arms beyond these simple (as far as they can be traced in the specimen), two to each ray, or ten in the whole series, and composed of somewhat shorter quadrangular pieces, provided with a well defined ambulacral furrow within. Surface merely finely granular.

Height of body to the top of the first radials, 0.12 in.; breadth, 0.23 in.

This little species will be readily distinguished from those already known from the coal measures, by its much more depressed, rapidly expanding body, as well as by its proportionally longer and constricted second radial pieces.

1869.]

*Locality and position.* Lower division of the Burlington group, at Burlington, Iowa. Lower Carboniferous. Mr. Wachsmuth's collection.

*ERINOCRINUS WHITEL, M. and W.*

Body of moderate size, very much depressed, or almost dish-shape, below the top of the first radials, being about three times as wide as high. Base very small, and entirely hidden by the slender, round column, when it is attached. Subradials small, forming together a nearly flat pentagonal disc. First radials comparatively large, thick and presenting a general quadrangular outline, there being scarcely any visible angle at the middle of the under side, which is distinctly shorter than the straight transverse upper edge, and about as long as the diverging lateral margins. Second radial pieces as large as the first, which they equal in breadth; broadly rounded on the outer or dorsal side, pentagonal in form, and each supporting on its superior sloping sides two arms, thus making ten to the whole series. Arms simple from their origin, flat on the outside, and composed of quadrangular pieces, the first of which is nearly as long as wide, and the others about half as long as wide, with scarcely any tendency to assume a wedge shape. Surface merely finely granular.

Height of body to the top of first radial pieces, measuring to their inner edges, 0.14 inch; breadth, 0.40 inch; breadth of column, 0.08 inch.

This species will be distinguished from the last by its more depressed body, which has its under side between the top of the first radial pieces and the column, slightly convex in outline, instead of concave, which results from the greater prominence of the basal and subradial pieces of the latter. The species under consideration likewise has its radial pieces proportionally wider, particularly the second radials, which also differ in being broadly rounded instead of angular on the dorsal side, and not constricted on their lateral margins. Its arm pieces are also flat, instead of convex, on their outer side.

Owing to the fact that the column entirely hides the very small base of this species, and the sutures between the subradials, or first range of pieces around the summit of the column, are rather obscure, and really look as if there were only three instead of five of these pieces, we were led to suspect that these might be the basal pieces, which would remove the species entirely from the genus *Erinocrinus*. On removing the column, however, we have been able to see what we believe to be five minute basal pieces within the first series surrounding the end of the column, which would necessarily have to be succeeded by five pieces in the next range. Hence, we think we can scarcely be mistaken in supposing the appearance of only three suture lines between the plates we

Dr. Shumard has suggested, in his Catalogue of North American Palæozoic *Echinerdormata* (Trans. Acad. Sci. St. Louis, ii, p. 358, 1866), that the curious genus of Crinoids described by Prof. Hall, in the Report of the Regents, cited above, under the name *Cheirocrinus*, may be the same type for which Prof. Hall had previously proposed the name *Calceocrinus*, in the second volume of the Palæontology of N. Y. The name *Calceocrinus* was proposed by him for some subtrigonal pieces of a Crinoid, which, judging from his figures and description, certainly resemble *very closely* the basal piece of the subsequently proposed genus *Cheirocrinus*,—so closely indeed, that we are much inclined to adopt Dr. Shumard's suggestion that they may belong to the same type. Still it seems very improbable that Prof. Hall, with the original typical specimens of his *Calceocrinus* (of which he says many specimens, all agreeing in form, have been found) at hand for comparison, should have been less liable to understand their true relations to his subsequently described type than others, with only his figures and description of *Calceocrinus* accessible for comparison, and consequently proceeded to redescribe the same genus under another name, that he had previously called *Calceocrinus*.

The synonymy is also unfortunately still farther complicated, by the fact that Prof. Hall happened to select for one of the above mentioned genera, proposed by him, the name *Cheirocrinus*, which had been used by Eichwald in 1856 for a genus of Cystidians. Eichwald's proposed genus seems to be nearly related, as he has stated, to *Echino-encrinites*, though it is very probably distinct. If so, then the name *Cheirocrinus* would have to stand for his type, and could not be retained for that described by Prof. Hall, even if distinct from his *Calceocrinus*. In that case, to avoid confusion, the form here under consideration might be called *Eucheirocrinus*.

Until these questions of synonymy can be cleared up, however, we prefer to describe our species, provisionally, under the name *Calceocrinus*; although, if the type of that genus is distinct from *Cheirocrinus*, and the latter name can stand, they would have to be ranged under it, as they are clearly congeneric with the types for which it was proposed.

It is evident that this remarkable genus differs so widely from all the other known types, that it must be regarded as belonging to an entirely distinct and unnamed family, which might be called *Calceocrinidæ*, as it is almost a certainty that *Calceocrinus*, even if generically distinct from the forms here under consideration, would at least belong to the same family, and if they are generically identical, *Calceocrinus* being the older name, would have to stand for the typical genus.

#### CALCEOCRINUS? BRADLEYI, M. and W.

Body exclusive of the base subquadrangular, with the upper lateral angles obliquely truncated, and the sides rather deeply sinuous, or constricted above the middle; compressed antero-posteriorly, and rather distinctly concave in the central region of the dorsal side below the middle. Lower dorsal plate triangular, and more than twice as wide as high. Dorso-lateral pieces twice as high as wide, presenting an irregular pentagonal outline, with sloping sides above diverging at an angle of about 90 degrees. Upper dorsal plate about half the size of the lower, subtriangular, or nearly semicircular, slightly more than half as long as wide, and scarcely more than filling the notch between the inner sloping sides of the dorso-lateral pieces. Dorsal arm slender, rounded, and composed first of five pieces, the lower of which is expanded below so as to be nearly three-fourths as large as the upper dorsal piece; while the succeeding pieces are narrow and slightly longer than wide, excepting the fifth one, which is a little wider than the others, pentagonal in form, and supports upon its superior sloping sides two equal divisions, which are slender, rounded simple, and composed of pieces about twice as long as wide. Lateral divisions of the rays (or perhaps, more properly, supports of lateral arms) composed of pieces that are wider than long, and rapidly dimin-

1869.]

ishing in size from the first to the terminal one; of these, three can be counted on one side, but there may have been one or two more; each supporting an erect arm, more slender than the dorsal one, and dividing first on the third piece, the inner division being smaller than the other and remaining simple, while the larger one bifurcates again on the fourth piece, the subdivisions being equal and of the same size as the inner branch at the first bifurcation. All the axillary pieces are expanded and more protuberant at the upper end than any of the others, though all of the other pieces are slightly projecting at the upper end. (Ventral side unknown.)

Column comparatively rather stout, or slightly thicker than the dorsal arm below its bifurcation, composed, two or three inches from the body, of round, nearly equal, moderately thick pieces, but near the body showing a slight tendency to become pentagonal, and apparently composed of more irregular, somewhat roughened pieces. Surface rather distinctly granular, particularly on the dorsal side of the body.

Length of body exclusive of the basal piece, 0.48 inch; breadth, 0.47 inch; length of dorsal arm to the first bifurcation, 0.62 inch; entire length about 1.80 inch; breadth of do., near the middle, 0.10 inch. Length of upper dorsal plate, 0.15 inch; breadth of do., 0.20 inch.

Compared with Prof. Hall's figure of the body of his *C. tunicatus*, and with specimens we have identified with that species, this form differs in having the body not narrowing upward, being as wide across, just above the constriction, as at the base of the dorsal-lateral pieces; the constriction of its sides is also distinctly above, instead of at the middle; while the outer sloping sides of its dorso-lateral pieces are proportionally shorter, and directed more obliquely outward. Its dorsal side, instead of being "flattened," is also distinctly concave below the middle. Again its upper dorsal plate is proportionally smaller, being considerably less, instead of more, than half the breadth of the body above the middle, and only just large enough to fill the depression in which it rests, without projecting above, while its lower sloping margins are rounded, so as to give it a semicircular outline, instead of being straight.

Compared with *C. nodosus*, Hall, the only other described species from this horizon, it will be at once distinguished by the nodose character of the latter. It likewise differs in the details of its structure from the various other species described by Prof. Hall from other horizons.

The specific name is given in honor of Prof. Frank H. Bradley, of Hanover College, late of the Illinois Geological Survey, who discovered the typical specimens, and numerous other fossils, at the same locality.

*Locality and Position.* Crawfordsville, Indiana. Keokuk division of the

four times as long on the outer side, as wide. Upper dorsal plate subtrigonal, with the lateral angles a little truncated obliquely outward, about twice as wide as high, and truncated about three-fourths its breadth above, for the reception of the middle or dorsal arm; more than filling the broad triangular notch between the upper ends of the dorso-lateral pieces.

Dorsal arm simple, and composed, above the first piece, of oblong pieces, that are rounded on the outer side, and about one third longer than wide. Lateral divisions of the rays supported on the superior latter sloping side of each dorso-lateral piece, composed each of (as far as can be seen) five pieces in a direct range, extending out laterally and curving around toward the ventral side; of these pieces the first is very short and does not support an arm, while each of the other bears an erect arm above. Each of these lateral arms, as far as can be seen, gives off a small division on the dorsal side of the third piece above the base, while the main division of each bifurcates again on the fourth piece above, the bifurcating pieces being a little tumid. All the arms have a deep ambulacral furrow within.

Pieces of the ventral side unknown.

Length of base, 0.10 inch; length of body exclusive of base 0.35 inch: breadth do., 0.27 inch; length of arms 1 inch.

This species is related to *C. dactylus*, Hall, but differs in having its dorsal arm simple, instead of bifurcating; and its lateral arms bifurcating first on the third, instead of the fourth piece. From *C. ventricosus*, Hall, it also differs in having the dorsal arm simple, instead of bifurcating, while its upper dorsal piece is distinctly shorter in proportion to breadth than in that species.

If farther comparisons should show these forms to be generically distinct from *Calceocrinus*, and *Cheirocrinus* is found to be tenable, this and the preceding species would have to be called *Cheirocrinus Wachsmuthi* and *C. Bradleyi*.

The specific name is given in honor of Mr. Charles Wachsmuth of Burlington, Iowa, to whom we are indebted for the use of the specimens from which the description was made out.

*Locality and position.* Upper Burlington beds of Lower Carboniferous, at Burlington, Iowa. Mr. Wachsmuth's collection.

### Genus GILBERTSOCRINUS, Phillips.

Subgenus GONIASTEROIDOCRINUS, Lyon and Casseday, 1859.

Syn. *Trematocrinus*, Hall, 1860.

#### GONIASTEROIDOCRINUS TENUIRADIATUS, M. and W.

The only specimen of this species we have seen is too much crushed to admit of a detailed description of the structure of its body. It evidently attained a medium size, however, and has unusually long, slender, pseudo-brachial appendages, or false arms; while its subradial pieces are produced into short pointed spines. Its false arms are each composed, near the body, of a double series of alternating semi-elliptic pieces, which are joined together by their straight sides, and each pierced by a small central canal. At a distance of about three or four pairs of these pieces from the body, each series of pieces diverges from the other at an angle of about fifty degrees, thus forming two very long, slender, rounded, gradually tapering branches, composed each of a single series of round pieces, generally less than twice as wide as long, with a small central canal. These pieces have their articulating surfaces radially striated, and could not be in any way distinguished from the joints of the column of many crinoids, if found detached.

From Prof. Hall's *speciestypus*\* (which also belongs to the section of the genus

\* A - this species is neither the type of the genus *Gilbertsocrinus*, nor of the subgenus *Goniasteroidocrinus*, the name *typus* can only serve to confuse and mislead the student in regard to the history and synonymy of the genus, and hence ought to be changed.

with the pseudo-brachial appendages composed, near the body, of a double alternating series of pieces, and bifurcating farther out into two rounded branches, composed each of a single range of pieces pierced by a small central canal), the species under consideration will be readily distinguished by its much longer and more slender pseudo-brachial appendages, which have their pieces merely rounded and finely granular, instead of being each provided with a row of small tubercles around the middle. From *G. tuberculatus*, Hall, (sp.), which, if correctly identified among the specimens before us, has its pseudo-brachial appendages constructed, at the base at least, in the same way, it will be distinguished by having its subradial pieces produced into short pointed spines, instead of being merely tuberculiform. The same character, as well as its larger size, and more robust appearance, will also distinguish it from our *G. fascellus* and *G. reticulatus*, Hall (sp.)

The specimen is too much crushed to afford measurements of the body, but the false arms measure 0.60 inch from the body out to the point of bifurcation, and 0.35 inch in breadth. Each of the branches near the point of bifurcation measures only 0.18 inch in thickness, while one of them can be traced to a length of 2 inches, where it is broken off, and measures 0.13 inches in thickness, the whole length of each branch being probably not less than three inches.

*Locality and Position.* Lower division of the Burlington group, Burlington Iowa. Lower Carboniferous. No. 308 of Mr. Wachsmuth's collection.

*GONIASTEROIDOCRIKUS OBOVATUS*, M. and W.

Body rather large, truncato-obovate, being narrow below, with convex sides, and truncated above; height a little greater than the breadth. Base small, and very deeply concave; basal pieces entirely within the concavity of the under sides, and hidden by the column, when it is attached; apparently completely inverted by the pushing in, as it were, of the column, around which they are folded down with their outer sides inward, while their edges that join to the subradials are turned downward. Subradials of moderate size, very tumid or tuberculiform, but not pointed; curving into the concavity below and upward at the outer ends, while their tumid central part forms the base upon which the body stands when placed upon a plane surface; all heptagonal in form, if we count an obtuse angle at the middle of the base of each. First radial pieces about as large as the subradials, tumid, and of nearly equal length and breadth; all heptagonal in outline. Second radial pieces generally smaller than the first, and proportionally a little narrower, rather tumid, and all hexagonal in form. Third radial pieces of about the same size as the

Surface very finely granular. Impressions at the corners of the plates also sometimes cause the appearance of a tendency to form a short obtuse radiating rib at each side of some of the plates, but this character is too faintly marked to attract attention.

Height of body about 1.70 inch, breadth, 1.60 inch.

The most marked feature of this species is its rather obovate form, produced by the narrowness of its lower part and its convex sides, and slight contraction near the top. The narrowness of its lower part results from the small size of its basal, subradial, and first radial pieces. The deeply sunken character of its base also contributes to the same result, as it is not near so wide as it would be if its pieces extended out horizontally from the column, instead of being folded down with their backs against it. It seems to resemble *G. tuberculosus*, Hall (sp.), more nearly in general appearance than any other species known to us, but will be readily distinguished, not only by its different form, but by the proportionally smaller size of its basal, subradial, and first radial pieces, but more particularly by the structure of its false arms, which are each composed at the base of six ranges of pieces, instead of only two.

*Locality and Position.* Upper division Burlington Group, Burlington, Iowa. Lower Carboniferous. No. 379 of Mr. Wachsmuth's collection.

#### Genus LEPIDOCENTRUS, Müller (?) 1856.

Entire form unknown. Interambulacral plates rather thin, very irregular in size and form, all strongly imbricating apparently from below, and toward the lateral margins of the areas; arranged in five or more rows, only the outer two of which seem to be continued to the extremities of the areas, all occupied with generally obscure secondary granules, and most of those on the lower (?) side of the body also provided with large primary central tubercles and spines; primary tubercles sometimes showing a small pit in the top, surrounded by two smooth rings, separated by an annular furrow, and all without any ring, depression or prominence around the base; on the upper (?) side of the body, only the marginal rows provided with primary tubercles. Ambulacral areas wide, and occupied by six or more irregular rows of unequal, irregular pieces, some of which are as large as the smaller interambulacral plates, and all strongly imbricating in the opposite direction from the interambulacral series; each pierced by two pores, and the larger ones usually marked with one or two additional pits, which, with the pores, are surrounded by a large circular impression, while some of them sometimes show a tubercle intermediate in size between the primary and secondary series. Apical disc unknown, but a single rather large plate believed to belong to it is seen to have six or seven pores circling around near its outer margin, and a small tubercle in the middle.

This type is related to several of the other palæozoic genera, but cannot be properly referred to any of them. In the great irregularity of its interambulacral plates, both in size and form, as well as in the absence of primary spines, excepting on the marginal rows (at least on the upper (?) side of the body) it seems to be very similar to *Perischodomus* of McCoy. It differs, however, clearly from that group in the much greater breadth of its ambulacral areas, the greater number of ranges of ambulacral pieces and their greater irregularity, as well as in the much larger sizes of some of them, and their peculiar circular impression around the two pores. If *Perischodomus* has its plates not imbricating, that would also be another important difference, but although that character is not mentioned in the description, we suspect it may really exist, because we find it to occur in all the analogous types in this country.

From *Lepidechinus* it is also readily distinguished, by the much greater breadth of its ambulacral areas, and its more numerous rows of ambulacral pieces and pores, as well as by the larger size and the other peculiarities of these species.

In the breadth of its ambulacral areas, and the number of rows of pieces occupying the same, it is more nearly related to our *Lepidesthes*; but it differs

1869.]

in the great irregularity of these pieces, both in size and form, as well as in the curious circular impressions of the same: also in the possession of large primary tubercles and spines on some of the interambulacral pieces.

It is probably more nearly related to the form referred in this paper, doubtfully to *Ecidaris*, but it differs materially in the much greater breadth of its ambulacral areas, more numerous ranges of ambulacral plates, and the larger sizes, and other peculiarities of these species; as well as in not having primary spines and tubercles on all of its interambulacral plates.

NOTE.—After preparing the foregoing description, with the view of proposing a new genus for the reception of this fossil, our attention was called by Prof. Alexander Agassiz to a very similar type, that was published by Müller under the name *Lepidocentrus*, in 1856, from the Eifel Limestone (*Aus den Abhandlungen der Königl. Akad. der Wissenschaften zu Berlin*, p. 258, taf. lll); but which has been entirely overlooked by subsequent authors. After comparing our specimens with the figures and description in Müller's paper (a copy of which Prof. Agassiz was kind enough to loan us), we find our type agrees so nearly with his genus, in all the parts known to him, that we have concluded to refer it provisionally to the same. Müller, however, knew nothing of the nature of the ambulacral pieces of his type, and we have therefore no means of comparing these important parts. As it is already known that there are various genera of these older types, agreeing in some characters and differing in others, it is quite probable our fossil may belong to a distinct genus. If so, we would propose to call it *Pholidocidaris*.

#### LEPIDOCENTRUS IRREGULARIS, M. and W.

The specimens of this fossil that we have had an opportunity to study are too much crushed and broken to give a clear idea of its general form, or to admit of being systematically described. It seems to have attained a rather large size, however, and if of a depressed subglobose form, may even have measured as much as three and a half to four inches in its transverse diameter. Some specimens show from five to six ranges of interambulacral plates lying together, so as to indicate that there were at least that many ranges between the ambulacra at that point. These six ranges, as they lie flattened by pressure, measure about two inches across.

All of these interambulacral plates are thin and sharp at the edges, and of only moderate thickness in the central region, while they present such a variety of forms that it would scarcely be possible to give a correct idea of their outlines, without describing each individual plate. They are generally a little longer than wide, however, and what appears to be a part of the body below

nearly in their relative positions, excepting that they are all spread almost on a plane, and more or less displaced and broken by accidental pressure. Here, near the ends of the areas, there are apparently only two rows of interambulacral plates in each series, the two ranges measuring together only about 0.40 inch in breadth; soon, however, they pass into three or four ranges. The ambulacral areas, at about one inch from the apparent position of the oral orifice, measure nearly an inch in breadth, and, as near as can be counted, there appear to be there six or more ranges of ambulacral plates. These plates appear to increase in size and decrease in number toward the end of the areas, so that some of them are there nearly as large as the adjacent interambulacral plates. They are generally wider than long, and as they lie together present more or less rhombic faces, arranged somewhat like the scars on the surface of some species of *Lepidodendron*. This similarity is also increased by the pores, and some little pits in the central region, surrounded by the circular depression. Some of the larger of these plates have the pores near one end, and a tubercle occupying the middle, nearly as large as the primary tubercles on the adjacent interradians. These probably belong to the middle ranges.

The larger primary spines attained a length of about one inch, and a thickness of 0.10 inch at the head, which is a little swollen; above this they taper rather gradually, are rounded, nearly straight, and marked by minute, crowded, longitudinal striæ. Among the ambulacral plates there are also seen lying scattered about a number of other spines, from one-fourth to one third the size of those described, and of very nearly the same form. These seem to belong to the ambulacral plates, on most of which we see a tubercle larger than the secondary tubercles of the interambulacral plates. Many much smaller spines than the latter are likewise seen, that probably belong to the secondary, or perhaps, more properly, tertiary series.

*Locality and position.* Hamilton and near Nauvoo, Illinois; in the Keokuk division of the Lower Carboniferous Series.

#### EOCIDARIS? squamosa, M. and W.

Body attaining a large size, apparently depressed-subglobose in general form. Interambulacral plates rather thick, in eight or more longitudinal rows near the middle of each area,\* but apparently only the two outer rows continued to the oral aperture; all presenting the usual hexagonal form, excepting the pentagonal marginal rows, and distinctly imbricating apparently from the lower side upward,† as well as inward toward the central row, excepting the two outer rows on each side, the lateral imbrication of which is outward, that is, the outer row laps the edge of the ambulacral series, and the next range laps the edge of the outer row, while its inner edge laps that of the next row within, and so on to the middle row, which is lapped on both sides; each with a comparatively large, smooth, saucer-shaped depression, occupying the central region, from the edges of which the surface is distinctly beveled off in every direction to the margins, the beveled edges that pass under the edges of the adjacent plates, however, being distinctly wider than those lapping the adjacent pieces, these lapping edges being as if ground off obliquely under, or in other words, beveled on the inner side; tubercles for the support of the primary spines smooth, prominent, rather large, and rising in the middle of the saucer-shaped central depression, narrowing upward to near the top, where there is a circular depression surrounding a very narrow, prominent, perforated, central process, for the immediate articulation of the primary spines; most convex part of each plate surrounding the smooth, saucer-shaped depres-

\* Eight rows are seen in the specimen at the widest part, but we are not sure this is the middle of the area, owing to the imperfection of the specimen.

† This imbricating character, as well as several others mentioned in the above description, may be of more than specific value, and they are mentioned here, along with specific characters, because we are in doubt in regard to the generic relations of the fossil.

sion, ornamented with a few very small pustules, upon which small secondary spines probably articulated. Primary spines, apparently one inch or more in length, rounded, slender and nearly or quite straight, with the articulating end perforated and a little enlarged, so as to form an undefined ring; surface ornamented with minute, crowded, longitudinal striæ, only visible by the aid of a good magnifier.

Ambulacra narrow, or only about equaling the breadth of the marginal rows of interambulacral plates on each side, slightly convex. Ambulacral pieces slightly imbricating in the opposite direction from the interambulacral series, of very unequal size and form, and irregularly arranged, most of those starting from the mesial zigzag suture, extending out so as to connect with the crenated lapping margins of the outer ranges of interambulacral plates, while many of those starting from the latter inward, wedge out more or less abruptly between the others, at various distances before reaching the mesial suture, so as to present the appearance of a strong tendency to run into two rows of pieces on each side of the mesial suture; each pierced by two pores, which, owing to the irregular arrangement of the plates, present the appearance of forming two double rows along near each lateral margin of each ambulacrum, or four rows to each of these areas. They might, however, with probably almost as much propriety, be counted as one double, strongly zigzag row on each side.

Near what appears to be the position of the oral opening, there is adhering to the specimen one half of a stout jaw, 0.60 inch in length. On its outer side it is cuneiform, a little arched, and provided with a broad, longitudinal, ex-centric furrow; its lateral margins are smooth, and near 0.30 inch in breadth at the base, and converge to a sharp edge within. We have now tolerable good evidence that all the different genera of the *Perischoechimidae* are provided with strong jaws.

The specimen is too imperfect to give a good idea of its general form or size. As it shows one of the interambulacral areas, however, to be near two inches broad, it is probable the entire fossil was not less than four and a half inches in its transverse diameter. The largest interambulacral plates measure about 0.35 inch in length and breadth, while those of the outer rows next the ambulacra are proportionally narrower. The primary spines seem to be about one inch or more in length, though we have seen none entire. The longest fragments we have seen, are about half an inch long, 0.10 inch in thickness at the articulating end, and 0.08 inch in diameter a little above, but without any taper toward the broken end. The ambulacral areas are only about 0.26 inch in breadth at the widest place, near the middle, and about four to six of their

## EXPLANATION OF THE CUTS AND OF THE LITHOGRAPH.

---

- Fig. 1. *Beluga rhinodon* Cope cranium, from above; from Upernavik.  
Fig. 1a. *Beluga rhinodon* teeth.  
Fig. 2. *Beluga declivis* Cope scapula.  
Fig. 3. *Beluga angustata* Cope scapula.  
Fig. 4. *Balæna cullamach* Chamisso; from north west coast; proportions approximate. (Capt. Scammon does not represent the recurved rictus figured by Chamisso.  
Fig. 5. *Megaptera versabilis* Cope; from California coast; drawn to a scale of .25 inch to a foot. This and all the remaining cuts reduced to two-thirds of the proportions given.  
Fig. 6. *Megaptera versabilis*, from below.  
Fig. 7. *Rhachianectes glaucus*; from the Californian coast; scale .25 inch to a foot.  
Fig. 8. *Rhachianectes glaucus* Cope, from below.  
Fig. 9. *Balænoptera velifera* Cope, approximate proportions; from coast of California.  
Fig. 10. *Balænoptera velifera*, approximate proportions; from Queen Charlotte Sound, February, 1865.  
Fig. 11. *Sibbaldius sulfureus* Cope, approximate proportions; from California coast.  
Fig. 12. *Globiocephalus scammonii* Cope; coast of California; about .5 inch to the foot.  
Fig. 13. Same, from below.  
Fig. 14. "Bottle-nose Grampus;" California coast; scale near .5 inch to the foot.  
Fig. 15. *Orca rectipinna* Cope, male; approximate proportions; California coast.  
Fig. 16. *Orca rectipinna* Cope, female; same scale and locality.  
Fig. 17. *Orca ater* Cope; Juan de Fuca Straits, 1868.  
Plate I. *Hyperaodon* from the shore of Narragansett Bay, near Tiverton, Rhode Island; from photographs obtained by Samuel Powell, formerly Secretary of the Academy, at Newport, Rhode Island.



Cab. N. H.) in which *some* of the interambulacral plates are provided with a large central tubercle, while others apparently have none. We are not informed whether these larger tubercles are perforated at the end, as in *Archæocidaris* and *Eosidaris*, or whether they are without such perforation, as in *Palæchinus*; but if it belongs to the same *family* as that including *Palæchinus*, of which *Lepidechinus* is supposed to be a sub-genus, it is almost certain that its tubercles are not perforated.

At any rate, our fossil differs from *L. varispinis* in the following characters, that seem to be of more than specific importance. In the first place, it differs materially in the very irregular nature of its ambulacral pieces, which show a strong tendency to pass into, and in fact do, at some places, actually pass into two rows on each side of the mesial zigzag suture, instead of having clearly but a single row on each side, with each piece extending entirely across from the mesial suture to the lateral margins. Again, it differs in having a large central tubercle and spine on *each one* of all the plate of the *entire* interambulacral series. The lateral imbrication of the plates, in our type, is also different, the direction of the imbrication being inward, excepting in the two outer rows on each side, instead of outward in the whole series, the middle row being clearly lapped on each side, instead of lapping those on each side of it.

The strongly imbricating character, especially of the interambulacral plates in our type, is a very marked feature throughout; the lapping edges being sometimes at least one-fourth the entire breadth of these pieces, and yet, owing to the accuracy with which they are beveled, they lie so evenly together that this peculiarity is scarcely apparent where the plates have not been displaced. We are not aware whether this imbricating character of the plates has been observed in any of the European types on which the genera *Eocidaris* and *Archæocidaris* were founded.\* It is certainly more or less marked, however, in several of the American forms now before us that have been referred to the latter genus. For instance, it is clearly seen in the typical specimen of *A. Agassizi*, of Hall, and less distinctly in his *A. Shumardi*. We can also see indications of it in *A. Wortheni*, of Hall, though owing to the thinness of its plates, the beveling of their edges is less apparent. All these species have the peculiar ring or prominence around the base of the tubercles supporting the primary spines, seen in the true *Archæocidaris*, and distinguishing it from *Eocidaris*. It seems therefore probable that this character *may* be more or less marked in both *Archæocidaris* and *Eocidaris*, but most apparent in species which, like that we have here described, are provided with plates of more than the usual thickness.†

So far as we are aware no European species of *Eocidaris* showing the structure and arrangement of the ambulacral series of pieces has been discovered; at least we have seen no figures or descriptions of such. Prof. Hall, however, has described a species from the Chemung group of New York (Twentieth Report Regent's Univ. p. 298), to which Vanuxem had given the name *Echinus Drydenensis*, but which is said to be an *Eocidaris*. In this the ambulacral plates are described as being in two ranges without any intercalated pieces, if we understand the description correctly.

From all that is therefore known in regard to the several types mentioned, we are much inclined to believe that our fossil will be found to belong either to a distinct subgenus under *Eocidaris*, or to an allied new genus. In either case we would propose for the group the name of *Lepidocidaris*.

*Locality and position.*—Lower beds of the Burlington group, Burlington, Iowa. Lower Carboniferous. No. 404 of Mr. Wachsmuth's collection.

\* Some of Prof. Desor's figures of the plates of *Eocidaris* appear to show indications of marginal beveling, while others do not.

† Since this was written we have been led to believe this imbricating character of the plates is more or less defined in all the *Archæocidaridæ* as well as in some of these older types, apparently not belonging to that family.

## PALÆCHINTS GRACILIS, M. and W.

Body small, and apparently oval or subglobose. Interambulacral areas a little convex. Interambulacral plates in seven rows at the middle, but apparently only the marginal rows of pentagonal pieces are continued to the upper and lower extremities of the areas, the intermediate hexagonal pieces running out at various distances between the middle and the ends of the areas; thickness of each about half the breadth of the largest; all ornamented with closely set granules, of which 25 to 30 may be counted on each of the larger pieces. Ambulacral areas slightly convex, and equaling in breadth the first and second rows of interambulacral plates on each side; composed of very short pieces, which are a little thinner than the interambulacral plates, and about three times as wide as long, the widest part of every alternate one being at the outer end, which is received into a little sinus in the adjacent marginal interambulacral plate (there being generally three of these little sinuses to each of these plates), while the intermediate pieces usually wedge out rather abruptly before quite reaching the lateral margins; the two pores at the outer end of each piece arranged so as to form two zigzag or undulating rows along the lateral margins of each ambulacral area; surface of the whole series occupied by granules of the same size as those of the interambulacral plates.

Entire dimensions unknown; greatest breadth of interambulacral areas 0.76 inch; do. of ambulacra, 0.22 inch; number of ambulacral pieces in 0.10 inch, on each side of the mesial suture, ten.

This species will be readily distinguished from our *P. Burlingtonensis* by the proportionally greater breadth of the ambulacra, and the smaller size, and greater number of its interambulacral pieces, there being seven rows of the latter pieces at the widest part of the area, at a point equaling the breadth of these areas in *P. Burlingtonensis*, where there are only four or five rows of these pieces. Again its ambulacral areas are equal in breadth to the first and second rows of interambulacral plates on each side, taken together; while those of *P. Burlingtonensis* are scarcely wider than the single marginal row on each side.

*Locality and position.*—Upper division of the Burlington group, Burlington Iowa. Lower Carboniferous. No. 407 of Mr. Wachsmuth's collection.

## Note on the Genus ONYCHASTER, M. and W.

The borrowed specimens from which we made out the outline cuts and description of this type, published in the third volume of the Illinois Geological Report, p. 526, had been, to a great extent, denuded of their outer covering in cutting away the rather hard firmly adhering matrix before coming into our

in the specimen illustrated by us are the oral and adjacent pieces accidentally pushed upward, and seen from the upper or inner side after the removal of the dorsal side or covering; and that the central opening is the oral aperture. At any rate we know of no other way to account for the very different appearances presented by these fossils, when examined in different conditions.

Since we have had some specimens of this type at hand which we have felt at liberty to grind and cut into, so as to reveal more clearly their structure, we find that the arm-pieces, which in the denuded specimen first examined by us presented the appearance of becoming isolated, deeply furrowed lanceolate pieces, at a little distance from the body, and of very little thickness or depth, really appear, when ground off, to extend nearly all the way down from the dorsal to the ventral sides of the arms, and to be connected and articulated together, like those nearer the body by little processes and sockets; the comparatively thin furrowed dorsal edges becoming thicker farther in.

Sometimes these arm-pieces appear as if consisting of two rows joined in pairs at their inner ends along the middle of the dorsal side, there being a rather large pore (or possibly only a deep pit) at the junction of the two pieces forming each pair. In other instances, as seen detached, these pairs of pieces are found to be firmly anchylosed so as to form single pieces, extending across the whole breadth of the arms, without, however, obliterating the appearance of a rather large mesial dorsal pore.

We have not yet had an opportunity to see the under side of the body or arms in any of the Crawfordsville specimens, but Mr. Wachsmuth has a specimen from the Burlington division of the Lower Carboniferous beds of Burlington, which would seem to belong to this genus, though specifically distinct.\* This is the form Prof. Hall has described in some preliminary notices of fossils (issued at Albany, N. Y., in 1861), under the name *Protaster? Barrisi*. This fossil has, so far as we have been able to see, essentially the same structure, and shows along the under side of the arms a broad shallow depression in the arm-pieces, somewhat like an ambulacral furrow. None of the specimens of either species we have seen show any indications of any proper extended disc, the body being comparatively small. It also evidently differs in several points of structure from *Protaster*.

So far as its structure is yet known, it seems to be a true *Ophiurian*. We only know the species, *Onychaster flexilis*.

---

### Remarks on the BLASTOIDEA, with Descriptions of New Species.

BY F. B. MEEK AND A. H. WORTHEN,  
Of the Illinois State Geological Survey.

In regard to the nature of the functions for the performance of which the openings in the summit of this group of fossils, as the specimens are usually found, were designed, authors do not entirely agree. The central opening has been most generally regarded as the mouth, and the others surrounding this (excepting one that is always larger than the others) as ovarian apertures; while the larger one is usually supposed to be the anal aperture, with, in some types, two of the supposed ovarian apertures opening into it, one on each side.†

---

\* We have not yet, however, seen any of the little articulating knobs on the scales of this Burlington species. These impart the granular appearance to the surface of our typical species, in which each scale has one of these little knobs articulated in its middle. If the Burlington species did not have these, it may belong to another, but allied genus.

† In the genus *Pentremites*, as specimens are usually found, there are five of these openings of the summit, surrounding a central pentagonal aperture. Of these five surrounding openings, four are known to be divided within into two each, and the fifth one into three, the middle one of these three being generally supposed to be the anal opening.

Dr. F. Roemer, who in 1852 published a beautiful and valuable monograph of most of the species of this group then known, giving accurate illustrations of almost the entire anatomy of the genus *Pentremites*, including the arms or pinnae, and other parts not previously illustrated, regarded the summit openings in that genus as stated above. He noticed, however, that in *Nucleocrinus* (= *Elmeria*, Roemer) the central opening is covered in by a series of small plates, and that in *Codaster*, the openings corresponding to the so-called ovarian apertures of *Pentremites* seem to be absent.\* At that time Dr. R. was apparently not aware of the fact that Owen and Shumard had, in 1850, announced that all of the summit openings in *Pentremites Godoni* are, in perfect specimens, covered by minute plates,† as had been shown by himself to be the case with the central opening in *Nucleocrinus*, since he seems to have regarded this character as one of the distinctions between the latter genus and *Pentremites*.

Dr. Shumard has also since shown that this character not only occurs in other true *Pentremites*, such as *P. conoides*, *P. sulcatus*,‡ etc., but that at least the central hiatus in several species of the genus *Grenatocrinus* (= *Pentremites*, section *Altipetici*, of Roemer), such as *G. Sayi*, *G. mela* and *G. Norwoodi*, is also known to be covered in the same way, in perfectly preserved specimens.

Dr. C. A. White, the present able State Geologist of Iowa, also announced, in a very interesting paper on the summit structure of the Blastoiden, published in 1863, that in well preserved specimens of *Pentremites stelliformis* the central and anal openings are both covered by small pieces § He likewise stated in the same paper that he had seen specimens of *Grenatocrinus Norwoodi* with the central hiatus covered by small pieces, and that from this covering a double series of minute alternating pieces could be seen extending out the mesial furrow of each pseudo-ambulacral area for some distance.]

We have also seen specimens of *Pentremites stelliformis*, *Grenatocrinus mela*, *G. Norwoodi* and *G. Sayi* (most of them belonging to Mr. Wachsmuth's collection), showing the central opening covered by small pieces, and continuing out from

---

and the other two, one on each side of this, like those of other internal openings, are most generally viewed as ovarian apertures. In some species of *Grenatocrinus*, however, the openings corresponding to the four in *Pentremites*, divided into two each within, actually appear at the surface as four pairs of distinct openings, while in other types, such as *Nucleocrinus*, and some species apparently allied to *Codaster* (more properly *Codaster*), the supposed ovarian apertures appear as five pairs of separate openings, all distinct from each other, as well as from the anal opening.

As was first illustrated by Dr. Roemer, these so-called ovarian pores are known to connect with a series of compressed tubes within the cavity of the body, extending down along the inner side of each pseudo-ambulacrum so as to connect with the numerous minute pores passing through the central margin of these areas. Of these I have

these, a double series of minute alternating pieces a short distance along the mesial furrows of each pseudo-ambulacral area, as Dr. White mentions seeing in *Granatocrinus Norwoodii*.<sup>\*</sup> These little pieces do not *fill* the linear furrows, however, but *cover them over*, so as to leave a small canal passing along under them, and under the little vault covering the central opening, in such a manner as to communicate through the latter with the visceral cavity within the body.

From all that is therefore now known, we think there is little room for doubting that at least the little central opening seen in these fossils, in the condition in which the specimens are usually found, is really, in perfect examples, always covered by small pieces in all the different genera. We also regard this little covering of minute pieces as corresponding to the ventral disc, or vault, of the typical Crinoids, this part being here reduced, as it were, to its minimum size by the closing in of the surrounding parts. Hence we incline to concur with Dr. White in the opinion that the pieces composing this disc, at least in *Nucleocrinus*, *Granatocrinus* and *Pentremites stelliformis*, if not indeed in all the Blastoids, were not constructed or arranged for being opened and closed at will, to admit food into the mouth, whatever may have been the nature of those covering the other openings.<sup>†</sup>

In 1862 M. M. Dujardin and Hupé, who were not aware that any of the openings in the summits of these fossils, excepting the central one in *Nucleocrinus*, were ever covered by small pieces, expressed the opinion, in their valuable work on the *Echinodermata*, that the so-called ovarian apertures in the Blastoids are not such, but that they and the internal tubes<sup>‡</sup> with which they connect, along with the pseudo-ambulacral pores, constitute the respiratory apparatus of these animals, while the aperture usually regarded as the anal opening they consider the ovarian orifice. From the fact that they seem to believe that the typical palæozoic Crinoids were probably nourished by surface absorption, or through the agency of the column, rather than by food taken into a digestive apparatus through a mouth, we infer that they suppose the Blastoids had neither anal nor oral aperture.

In regard to the existence in the palæozoic Crinoids of a well developed digestive sack, however, analagous to that seen in the existing Crinoids, the discoveries made in this country certainly seem to leave little room for doubts, while it appears to us more in accordance with all that is now known in regard to the general anatomical structure, and the arrangement of the reproductive organs of the living types of the Crinoidea, to suppose that the opening usually regarded as the anus in the Blastoids was really such, or as Dr. White and Mr. Billings maintain, both mouth and vent, than that it was an ovarian aperture. The fact, too, that there certainly seems to have been no direct passage or communication whatever, so far as we have been able to see, between the interior of the internal tubes under the pseudo-ambulacra and the general visceral cavity, would also appear to be an objection to the conclusion that they and the external openings with which they connect were really respiratory organs.

<sup>\*</sup> These minute pieces we believe extended all the way down the ambulacral furrows in some, if not all types of the *Blastoidea*, and we even suspect that another series covered the little transverse furrows extending across to the bases of the pinnulæ, and possibly up the ambulacral furrows of the latter, as we have seen in the pinnulæ of *Balocrinus Christyi*.

<sup>†</sup> In *Pentremites conoides*, as figured by Dr. Shumard, the small pieces covering the central opening have, as suggested by him, in their regularity of form and arrangement, much the appearance of the pieces closing the so-called ovarian aperture of the *Cystodonta*; from which it might be inferred that in this genus these pieces might possibly have been movable, so that they could have opened and closed, as valves. We doubt, however, very much that they could have formed so striking an apparent exception to the corresponding parts of other types of the group. We think it probable that small openings exist under this little group of plates, at the upper terminations of the ambulacral furrows. This seems the more probable because Dr. S. describes these little pieces as being very differently arranged in *Pentremites sulcatus*.

<sup>‡</sup> These are generally more properly folds of a thin calcareous plate, but in the so-called *Pentremites stelliformis*, and other types, each separate fold connects with the inner wall all the way down, excepting at the upper end, so as to form a distinct compressed tube.

Dr. White has made the ingenious suggestion (See Bost. Proceedings already cited, that these internal tubes and the openings and pores passing into them<sup>o</sup> may have been for the purpose of drawing in water and injecting it into the pinnule, in order to elevate and move them at will, without the agency of a complex muscular system, apparently so inconsistent with the structure of a being so low in the scale of animal life. It is true the unelastic, rigid nature of these little calcareous tubes would seem to be an objection to this view, but this objection would doubtless apply with equal force against the opinion that they were respiratory organs.† Possibly, however, this apparent difficulty may have been obviated by the presence of thin membranaceous sacks within these tubes, susceptible of contraction and expansion to the extent of their internal cavities.

Our own observations, both of the typical Crinoids and of the Blastoids, have, as already stated, led us to believe that the series of small pieces, probably always originally covering the small central opening seen in imperfect specimens of the latter group, represents the vault, or ventral disc, of the typical Crinoids. We likewise agree with Dr White and others who reject the opinion that any of the other openings in these fossils were ovarian apertures.

In all the types of the Blastoides yet known, these little mesial furrows of the pseudo-ambulacra are distinctly seen leading to the central opening, precisely as the ambulacral furrows on the disc of *Comatula* lead to the mouth; and in the few types we have yet seen with this little central opening covered by minute vault pieces these furrows could be distinctly traced, as already stated, under the covering, into the central opening. Now, from the exact analogy of these furrows to those we have seen passing inward from the arm bases, under the small vault pieces covering the central opening in *Cyathocrinus*, and as distinct apparently tubular canals, made up of minute interlocking pieces, converging upward from the arm openings in *Actinocrinus proboscidealis*, to connect with the upper extremity of the convoluted digestive sack, nearly under the middle of the vault, we think the furrows alluded to in the Blastoids may be properly called ambulacral furrows.

In the true *Pentremites*, with wide lancet pieces,‡ the numerous little transverse furrows seen passing outward from these mesial longitudinal furrows, and along the pore pieces to the bases of the slender pinnule, are merely lateral branches of the central ambulacral furrow. In a specimen now before us, supposed to be *Pentremites elegans*, of Lyon and Casseday, the little pinnule, some of which are more than twice as long as the body, are each composed of a double series of alternately arranged pieces and provided with a distinct longitudinal furrow along the inner side, exactly corresponding to the ambulacral furrows in the arms and pinnule of the typical Crinoids. It is there-

suggested an idea that had sometimes occurred to us, that probably the pore pieces of the pseudo-ambulacral areas correspond to the recumbent arms in the Cystoidea.\* This certainly seems very probable, as it may be seen that the ranges of these pieces merely lap, as it were, down the sides upon the lancet pieces, and really form no part of the body, properly speaking. If this view is correct, each of the ranges of pore pieces of each pseudo-ambulacral area must, in the true *Pentremites* with wide lancet pieces, represent half an arm, the two halves being, as it were, split apart by the wide lancet pieces coming to the surface between. In *Granatocrinus*, *Nucleorinus*, and some other groups with merely linear lancet pieces, however, the two ranges of pore pieces meet along the mesial furrow of each pseudo-ambulacrum, and alternately interlock, just like the arm pieces in *Actinocrinus*, and other types in which the arms are composed of double rows of pieces. If these suggestions are correct, the little delicate free appendages often regarded as arms, would correspond to the pinnulæ, sometimes called tentacles in descriptions of fossil Crinoids proper, and Cystoids. The fact that these little appendages are themselves, at least in some types, composed each of a double series of minute pieces, would be no objection to this view, because this is exactly the structure of the pinnulæ in most of the Cystoidea with recumbent arms. The next question, then, would be in regard to supplementary pore pieces. These, if the so-called pore pieces† can be viewed as arm pieces, may be merely the first pieces of the pinnulæ modified to adapt them to the peculiar structure of the other parts.

*Supplementary Note to the foregoing remarks.*

A few days before receiving the proof-sheets of this paper from the printer, we were provided, through the politeness of Mr. Billings, with an advance copy of a very interesting and important paper of his on the Structure of the *Crinoidea*, *Cystoidea* and *Blastoidea*, to appear in the July number of the American Journal of Science and Arts. We cannot state here in detail the various points in which he agrees with or differs from us, but we will mention a few of the latter. In the first place, he does not concur in a suggestion made by us, in our paper read before the Academy in December, 1868, that certain facts seemed to indicate that in the palæozoic Crinoids the ambulacral canals might have been organized so that, in addition to their reproductive and other functions, they could have conveyed microscopic objects through the arm-openings, under the vault, to the digestive sack. He also thinks the convoluted internal organ and canals radiating from the summit of the same to the arm-openings, belong to the respiratory, and not to the digestive system.

With respect to the first suggestion, we would merely state that we are not disposed to insist upon it, as it was not stated by us as a demonstrated fact, but we rather intended to state facts that seemed to us to point to that conclusion. We were led to do so, in part, by the statements of Bronn, and Dujardin and Hupé, that the food of the recent Crinoids was probably conveyed along the ambulacral canals, by the action of cilia, to the mouth; and partly by the fact that in the palæozoic types, there seems to be no opening whatever in the vault, at the point to which the ambulacra converge, and where, from all analogy among recent Echinoderms, the mouth ought to be situated. We are aware, however, that there are some strong and perhaps insuperable objections to such a conclusion. And yet, there seems to be others of nearly or quite as much weight, against the conclusion that the single opening seen in the vault of these older Crinoids, always performed the double function of mouth and vent. Amongst these may be mentioned the fact that this opening

---

\* Since this was written we learn that Mr. Billings had arrived at the same conclusion in regard to the corresponding pieces in *Codaster*.

† The term pore pieces could not, of course, be applied to any of the pieces of the pseudo-ambulacra in the same sense that we would call the ambulacral pieces of an Echinoid pore pieces, because the pores in the Blastoids do not pierce these little pieces as they do in the Echinoids, but merely pass in between them.

is never situated at the point of convergence of the ambulacral canals, where the mouth ought to be, but more or less removed from it, so that if it performed both the offices of mouth and vent, it would be, as it were, the anal opening that did so, instead of the mouth, as in all of those cases among the existing *Echinodermata* with but one opening to perform both functions. In addition to this, we have, as we believe, demonstrative evidence that species of *Platycrinus* and *Goniasteroidocrinus* could, and did live, in some way, with the only opening (excepting the arm-openings) covered by a *Platyceras* that grew there, and sometimes not only so as to cover the opening, but in the case of the *Goniasteroidocrinus*, so as to cover nearly the whole vault. That these shells did not merely grow upon dead Crinoids lying at the bottom of the sea, is evident from the fact that these Crinoids thus found in such numbers, with a *Platyceras* attached, at Crawfordville, always have the arms and most delicate pinnule perfectly preserved; and in some other instances where the *Platyceras* is attached to the top of the vault, the arms of the Crinoid are found folded over the shell, as they would naturally fold together by the contraction of the muscles at death. Had these Crinoids remained uncovered by sediment at the bottom of the sea long enough after death for the *Platyceras* to grow upon them, their arms and pinnule would have fallen to pieces. If the only opening in the vault of these Crinoids was the vent only, we could readily understand how the excrementitious matter might have escaped under the foot of the *Platyceras*; but if it was both mouth and vent it is difficult to understand how, in such a case, food could have passed in.

Again, in many of the *Actinocrinus*, the only opening in the vault (except the arm-openings) is situated at the extremity of a long, slender, straight tube, rising from near the centre of the vault, though never from directly over the point of convergence of the ambulacral canals. And it is a remarkable fact, that of the hundreds of specimens we have seen with more or less of this tube preserved, we have never yet seen one that had its extremity unbroken. In several instances we have seen it from one to three inches in length, and so attenuated in the latter cases, that the internal cavity was not more than 0.05 inch in diameter, even in large specimens; and in others we have seen it scarcely more than one hundredth of an inch in diameter, and still the end of the tube in all cases broken. How small this canal must be at the end of an unbroken tube, we cannot say, but it must evidently be very small. If this little pore-like opening, situated at the extreme end of this long, straight, rigid tube, performed the functions of both mouth and vent, it would certainly seem to be a very unnatural and inconvenient structure.

In regard to the internal convoluted organ seen in so many of the *Actinocrinus*, which, according to the respiration system of the digestive system we would

Radial pieces nearly equaling the entire length of the body, and divided almost to their base by the pseudo-ambulacral areas, each with a broad deep sulcus extending up on each side of the pseudo-ambulacral areas, the entire length; while between this sulcus and each lateral margin, the surface swells out into a broad rounded ridge, widest near the middle of the body and narrowing upward and downward, these ridges on each two contiguous pieces being separated by a deeply sulcated suture. Interradial and anal pieces very small, subtriangular or cuneate-quadrangular, only about one-sixth the length of the body, measuring over the curve of the sides. Pseudo ambulacral areas very narrow or sublinear, with sides parallel, equaling the entire length of the body, slightly impressed above, but quite as prominent as the immediate margins of the radial pieces on each side below, if not wider; pore pieces about fifty on each side of the mesial furrow; supplementary pore pieces unknown; lancet pieces apparently not exposed externally. Openings of the summit small, but not clearly seen in the specimen.

Body of the typical specimen 0.45 inch in height; breadth, 0.5 inch.

The surface of the typical specimen of this species is not well enough preserved to show fine markings, but another individual of apparently the same species shows the lower half of the radial pieces to be ornamented with rather fine granules, so arranged as to look like fine transverse striæ under a magnifier, while a few stronger longitudinal striæ are also seen on this part of the body. In this specimen, however, the surface of the radial pieces is less convex between their lateral margins and the broad sulcus on each side of the pseudo-ambulacra, than in the typical form.

In form and the narrowness of its pseudo-ambulacra this species reminds one of *G. Sayi*, of Shumard, but it is at once distinguished by the very much larger anal and interradial and shorter radial pieces of that species, as well as by the canaliculate character of the sutures between the latter, with a rounded ridge on each side of this suture. In the comparative size of its radial and interradial pieces, as well as in the canaliculated sutures between its radial pieces, it agrees more nearly with *G. melo*, of O. and S., but is not only distinguished from that species by its subglobose form (a little wider than long) and merely even instead of concave base, but by its much more prominent pseudo-ambulacral areas below the middle of the body, and deep broad rounded sulci immediately on each side of these, and swollen surface between these sulci and the canaliculated suture separating the radial pieces. It moreover comes from the upper division of the Burlington group, while the vastly more common *G. melo* is only found in the lower beds.

*Locality and position.*—Upper beds of Burlington group, Burlington Iowa. Lower Carboniferous. No. 398 of Mr. Wachsmuth's collection.

#### GRANATOCRINUS PISUM, M. and W.

Body small, oval—subglobose, being slightly longer than wide. Base very small, rather deeply concave, and distinctly pentagonal in outline. Radial pieces long, truncato-subelliptical in general outline, with the lower end narrow, forming a nearly flat surface across between the pseudo-ambulacral fields, excepting below the middle, where these surfaces are concave; all divided nearly to their very bases by the pseudo-ambulacra, and without even the faintest trace of a furrow along up the sutures between their lateral margins. Interradial and anal pieces strongly incurved above, cuneate-subtrigonal in form and longer than wide, the length being about one fourth that of the whole body, measuring over the curve of the sides. Pseudo-ambulacra narrow, or sublinear, with very nearly parallel sides, there being a slight taper from above downward; all quite as convex as the slightly raised linear margins of the radial pieces on each side; pore pieces about twenty-six on each side of the distinct mesial furrow, along which their inner ends are minutely crenate, comparatively rather large, and ranging obliquely outward and downward; 1869.]

supplementary pore pieces unknown; lancet pieces apparently not visible externally, unless it is along the bottom of the mesial furrow.

Summit, when the minute pieces that doubtless closed the central region are removed, with a pentagonal opening of about the size of the anal aperture; so-called ovarian pores very small, and situated one on each side of each interrarial piece, and two others doubtless as usual opening into the anal aperture, which is nearly circular and much larger than the pores.

Surface finely granular, the granules being smaller and more crowded on a lanceolate area, extending up the radial pieces between the pseudo-ambulacra, and terminating just before reaching the interradians, and on each side, and above this space.

Height of body, 0.30 inch; breadth, 0.28 inch.

This little species might be mistaken for a small specimen of *G. mado*, by a hasty observer. It may be readily distinguished, however, by its longer interrarial pieces, less numerous and proportionally larger pore pieces, much more prominent pseudo-ambulacra, and particularly by not having even a trace of a linear furrow along up the sutures separating the radial pieces, and these pieces flat instead of convex across between the pseudo-ambulacra. The little projecting points at the bases of its pseudo-ambulacra are also directed more downward.

*Locality and position.* Upper part of the Burlington group, Burlington, Iowa. Lower Carboniferous. No. 397 of Mr. Wachsmuth's collection.

#### GRANATOCORINUS NEGLECTUS, M. and W.

Body small, varying from oval to subglobose. Base slightly projecting, pentagonal in outline. Radial pieces scarcely equaling two-thirds the entire length, and deeply divided by the pseudo-ambulacral areas. Interrarial pieces more than one-third the length of the body, cuneate-subtrigonal in form. Anal piece of about the same size as the interradians, but its upper extremity is erect and distinctly projecting, so as to form around the anal opening protuberant margins. Pseudo-ambulacral areas narrow, with nearly parallel sides, almost equaling the entire length of the body, nearly as prominent as the slightly raised margins of the radial pieces on each side; pore pieces twenty-five to thirty on each side of the mesial furrow; supplementary pore pieces unknown; lancet pieces apparently not visible externally.

Mesial opening of the summit very small; so-called ovarian apertures minute and situated one on each side of the interrarial pieces; anal opening comparatively large, with very prominent margins.

Surface of the radial plates between the pseudo-ambulacral areas longitudi-

legs, upon which the body stands when placed on an even surface, as in the last.

We have seen five specimens, all of which agree in the characters given.

*Locality and position.*—Lower division of the Burlington group, at Burlington, Iowa. Lower Carboniferous. No. 396 of Mr. Wachsmuth's collection.

GRANATOCRINUS GLABER, M. and W.

Body very small, pentagonal-subglobose, being somewhat wider than long and rather broadly truncated below, with the spaces between the rather prominent pseudo-ambulacral areas almost flat near the middle, and more or less concave below. Base about even with the most prominent part of the lower ends of the radial pieces, nearly flat, and very distinctly pentagonal, or almost pentapetalous in outline. Radial pieces forming about three-fourths the actual height of the body, abruptly incurved below to connect with the base, and all divided quite to the lower side of the body by the pseudo-ambulacral areas. Interradial pieces of moderate size, or about one-third as long as the body, measuring over the curve of the sides from their upper ends to the base; triangular in form and nearly as wide as long, all strongly incurved above; anal piece shorter than the interradials below the anal opening. Pseudo-ambulacral areas rather narrow, tapering slightly from above, and nearly as convex as the margins of the radials on each side. Pore pieces about twenty-five to thirty on each side of the mesial furrow of each area; supplementary pore pieces unknown; lancet pieces apparently not showing externally. Summit depressed in the middle; central and anal openings comparatively rather large; so-called ovarian pores of moderate size, situated one on each side of the inner end of each interradial piece, and of course two others as usual opening into the anal aperture.

Surface apparently quite smooth, even as seen under a magnifier, but probably when entirely unworn, marked by microscopic longitudinal striæ.

Height of one of the largest specimens, 0.21 inch; breadth, 0.23 inch; breadth pseudo-ambulacral areas, 0.04 inch; do. of spaces between the same, at the widest part, 0.13 inch.

This little species is so very clearly distinct from all others known to us, that it is unnecessary to compare it with any of those yet described. Its most characteristic features are its small size, smooth surface, flat space between the pseudo-ambulacral areas, and nearly even pentapetalous base.

We have before us nine specimens, of various sizes, all agreeing in the characters given excepting one, which, from abnormal development, has only four pseudo-ambulacral areas. As this agrees with the others, however, exactly, in all its specific characters, it is evidently a monstrosity of the same species, produced by the non-development of one of the radial pieces, by which means two of the pseudo-ambulacral fields are, as it were, welded together, to form one larger than any of the other three.

*Locality and position.*—Saint Louis division of the Lower Carboniferous series, in Hardin County, Illinois.

---

May 4th.

JOS. JEANES in the Chair.

Twenty-seven members present.

The following paper was presented for publication:

"A review of the species of *Plethodontidæ* and *Desmognathidæ*."

By E. D. Cope.

Mr. J. H. Redfield stated that on the 22d of April, in company with Mr. C. F. Parker, he had visited Cedar Bridge, Ocean Co., N. J., in search of *Corema Conradii*. This plant occurs in Newfoundland, on islands near Bath, Maine, 1869.]

at Plymouth, Cape Cod, and near Islip, Long Island, and was first discovered at Cedar Bridge by Prof. S. W. Conrad. This locality was visited by Dr. Torrey, about 1835, and carefully indicated by him in *Ann. N. Y. Lyc. Nat. Hist.* iv 83—so that there was no difficulty in finding the precise points mentioned; but Mr. R. was sorry that no trace of the plant could now be found there, and it has doubtless been eradicated by animals or by unscrupulous collectors, or has been otherwise unable to maintain its foothold in "the struggle for existence." The vicinity was also carefully examined, but without success. The plant is said to have once existed near Pemberton Mills, N. J., but as that neighborhood is now entirely under cultivation, there is no evidence that the *Corema Conradii* now exists south of Long Island. If it is again to be discovered in New Jersey, it will probably be in the wide sandy waste a few miles west of Cedar Bridge, near the boundary between Burlington and Ocean counties, where a succession of elevated ancient ocean beaches offer conditions similar to those of Cape Cod.

Prof. Cope exhibited bones and teeth of the large extinct Chinchilla of the island of Anguilla, W. I., *Amblyrhiza inundata*, and with them teeth of a second and new species, which he called *Loxomylus longidens*. It was also allied to the Chinchillas, and of large size. They were accompanied by a shell implement of human manufacture, which was, so far as discovery in an earthy matrix, and the color, etc., were evidence, of the same age as the Rodents.

---

*May 11th.*

DR. RUSCHENBERGER, Vice-President, in the Chair.

Twenty-eight members present.

The following papers were presented for publication:

"Further notes on Microscopic Crystals." By Isaac Lea, L.L. D.

"Sexual Law in the Conifera." By Thos. Meehan.

---

*May 18th.*

DR. RUSCHENBERGER, Vice-President, in the Chair.

Twenty-five members present.

The following paper was presented for publication:

"An attempt to reconstruct the organization of the Brain in the

average weight of the Brain in different races of Mankind," by Jos. Barnard Davis, reported in favor of its publication in the Journal.

On favorable report of the Committees, the following papers were ordered to be published :

**A Review of the species of the PLETHODONTIDÆ and DESMOGNATHIDÆ.**

BY E. D. COPE, A. M.

**Family PLETHODONTIDÆ.**

Gray Catalogue Batrachia Gradientia Brit. Mus. 1850, 31. Exclusive of the Amblystoma and Desmognathus.

Plethodontidæ Cope, Journ. Ac. Nat. Sci. Phil., 1866, 105.

Spelerpinæ Cope, Proc. Ac. Nat. Sci. Phila. 1859, 123.

Plethodontidæ, Bolitoglossidæ and Hemidactyliidæ, Hallowell, Journ. Ac. N. Sci. Phil., 1858, 338, 339.

No anterior axial bone ; palatines not prolonged over parasphenoid ; bearing teeth on the posterior portion. No postorbital arch.

Dentigerous plates on the parasphenoid.

Carpus and tarsus cartilaginous.

Vertebræ amphicœlian.

Occipital condyles sessile.

Prefrontals present, pterygoids wanting.

Prefrontals not prolonged or embracing frontals ; parietals slightly embracing.

Orbitosphenoids separated by membrane from proötic.

Vestibule, inner wall osseous.

The preceding diagnosis includes the characters assigned to the family by the writer in 1866, excepting one, i.e. the presence of the premaxillary fontanelle, which I find to be wanting in the genus *Stereochila* m.

In the characters of the scapular and pelvic arches this family does not differ from the Amblystomidæ and Salamandridæ. The foramen which separates the coracoid from the procoracoid is well marked and intermarginal ; in the Amblystomidæ it is smaller, and in the Salamandridæ marginal. The femur always presents a strong trochanter ; it is weak in *Stereochila marginata*. In *Hemisalamandra* and *Diemyctylus* it is quite weak, but in *Salamandra* strong.

In most of the genera of this family the enamel does not cover the entire crown of the tooth. In *Spelerpes rubra*, *longicauda* and *bellii*, and *Plethodon glutinosus* and *cinereus*, the external part of the crown terminates in a transverse cutting edge, while the inner extremity is more prolonged, leaving a transverse depression between the two. In *Sp. bellii*, the inner apex is transverse and prolonged a little beyond the external, while in the other *Spelerpes* and the *Plethodon glutinosus* the inner crown is more prolonged and incurved conic. In *P. erythronotus* it is a little more obtuse. In *Desmognathus* and the Amblystomidæ the two apices are of equal height, and are both transverse cutting edges, the outer narrowed in the former. In the larvæ of Plethodontidæ that I have examined, the crowns are more simple. The teeth of *Anaides* are more like those of the *Cocilia* or of *Hylonomus* of the coal measures, and distinguish the genus from other Plethodontidæ.\*

This family is more remote in its skeletal characters from the Salamandridæ and Pleurodelidæ, than is the Amblystomidæ. Thus the absence of parasphenoid brushes, the ossification of the tarsus and carpus, and the persistence of the pterygoid bones are characters common to the two latter, and wanting in

---

\*See Proceed. Acad. N. Sci. Phila., 1859, 124.

the present family. On the other hand, the non-prolongation posteriorly of the vomers, and the amphiœlian vertebræ, belong to this family and the Amblystomidæ only. The position of the latter family is therefore between the Plethodontidæ and the Salamandridæ. The Amblystomidæ and Plethodontidæ may be thus compared with reference to the developmental character of the features which distinguish them.

**AMBLYSTOMIDÆ.**

Superior.

Carpus and tarsus osseous.

Premaxillary fontanelle closed.

Inferior.

O. pterygoideum persistent.

**PLETHODONTIDÆ.**

Inferior.

Carpus and tarsus cartilaginous.

Premaxillary fontanelle open.

Superior.

O. pterygoideum obliterated.

The inferiority of some Plethodontidæ is seen in the non-distinction of the digits (*Geotriton*), the thinness of the ossification of the parietal membrane bones (*Batrachoseps*), and in *Opheobatrachus lineolus* m, from *Vera Cruz*, the persistence of the membranous cranium by the limitation of the parietal bones to two small lateral scales, and the wide divarication of the posterior extremities of the frontals.

Most characters of this family are those of low development, and approximations to the larval condition, except the loss of the pterygoid; two of the species exhibit a subocular cirrus, which occurs in some of the *Gymnophidia* (*Urocilina*) and *Dactylethra* among *Anura*. It is probably the persistence of that long subocular tentacle characteristic of the early larval stage of *Salamandridæ* and *Pleurodelidæ* (e. g., *Salamandra Notophthalmus*), and of a later larval stage of *Dactylethra* (vid. Wyman and Gray), where they resemble the appendages of the *Siluridæ*. They have been called crochets by Rusconi, and homologized with the cylindric cephalic processes of the larval *Rana*, with what correctness remains to be proven by observations on other types.

Eschscholtz correctly represents *Batrachoseps attenuatus* as without prefrontals. An elongate process of the frontal occupies only part of its place, forming no suture with the maxillary; this is quite different from *Desmognathus*, where the orbit is completed by the union of frontal and maxillary. In *Batrachoseps quadridigitatus* the prefrontal occupies this depression as an elongate vertical scale.

In *Spelerpes rubra* the quadratum presents a small internal anterior ala, which has a superficial resemblance to a pterygoid. In this species there is apparently an azygus bone behind the premaxillaries; this is, however, only the exposed extremity of their united spines, which are nearly or quite isolated by the approximation of the anterior parts of the nasale. It does not

Section II. The tongue free all around, attached by its central pedicel only. (Spelerpes).

A. Two premaxillary bones (with fontanelle).

Digits 4—5, closely united by a broad palmar membrane..... GEOTRITON.

Digits 4—5, entirely free..... GYRINOPHILUS.

AA. One premaxillary bone (with fontanelle).

a. Digits 4—4.

Digits free, parietal and palatine bones well ossified..... MANCULUS.

aa. Digits 4—5.

Digits little distinct; parietal cartilages not ossified; two patches on parasphenoid teeth..... OPHEOBATRACHUS.

Digits entirely confounded as an undivided palm or sole; cranial bones well ossified..... EDIPUS.

Digits all free, cranial bones well ossified..... SPELERPES.

The generic relationships of the above named groups are exceedingly simple, and the ease with which the animals can be analysed, renders the case clear from the doubts which constantly arise in discussions of generic relationships as to the probable omission of characters from the argument. Here it can be safely asserted that, as far as the skeletons are concerned, there exist no other generic distinctions than those given above. If now any principles can be derived from consideration of the osseous system, that which of all others presents us with by far the greatest number of minute modifications of structure, the same may be with considerable probability inferred for the other systems.

The primary groups are distinguished by the different degrees of attachment of the tongue. That form which is most attached, represents, and is identical with, an immature stage of the species of Sect. second, where it is more extensively free, as any one may satisfy himself by the examination of a larva of Spelerpes at a certain period. The tongue will be found to be that of Plethodon.

The secondary groups are distinguished by the separation or confluence of the premaxillary bones. Those presenting the latter type exhibit separate premaxillaries during the early portion of larval life, though the union often takes place very early. The number of digits distinguishes groups of genera of less value; in some the hind limb has five digits, in others four. In an early larval stage all possess but four digits, and in some of those with five the inner consists of one phalange only, even at maturity, (Spelerpes *chiropterus*, et aff.), not having as complete a series of larvæ of Spelerpes and Plethodon, as of *Amblystoma punctatum*, the development of the digits in the latter will indicate the meaning of variations in the same at maturity. At a length of 1.2 mm. the fore limb only is projected, and bears two digits only, as in the genus *Proteus*. At 1.5 mm. sometimes the posterior limbs are developed, sometimes not; and from this size to 2.5 mm. the number of digits bears little relation to the size of the animal, an additional digit sometimes appearing earlier, sometimes later. Their numbers are then at first 2—0; then always 3—0; with the hind foot divided, they are 3—2, and then 3—3. Sometimes the anterior digits are complete in number before the hind limb appears, and we have combinations of numbers from 4—0 to 4—3, 4—4, and the full number 4—5, which is found in all specimens of 2.5 mm. and upwards. Genera which exhibit reduced digits are in *all* other respects Spelerpes (i. e. *Manculus*) or Plethodon (*Hemidactylum*) or *Hemidactylum* with unossified parietal bones and consolidated premaxillaries (*Batrachoseps*). Applying the case of *Amblystoma* to these, we could not assert that *Hemidactylum*, for instance, is *identical* with the undeveloped stage of Plethodon, since when *Amblystoma* exhibits digits 4—4, it is branchiferous. But making the more  
1869.]

legitimate comparison with *Plethodon* itself, I find that the complete number of posterior digits appears much later in life than in *Amblystoma*, that development in this regard is retarded, while in respect to the gills it is accelerated. Thus in *Plethodon erythronotus* the exterior digit is longer than the interior; in specimens of 2.4 mm. the outer digit is the shorter; in those of 1.0 mm. which are without gills, it is a very minute tubercle on the outer metatarsus. In a little earlier stage it cannot but be wanting, though this I have not seen, and I have little doubt that it is then a *Hemidactylum*, unless indeed the parietal bones be not ossified.

Another foetal condition rendered permanent is seen in the generic character of the genus *Ædipus*, which differs from *Spelerpes* solely in the foetal non-separation of the digits. In the larva of *Sp. rubra*, the digits are early entirely distinct, so that so far as this species is concerned *Ædipus* presents an *inexact parallelism*, but they are also more distinct than in the mature *Spelerpes bellii*, where, as might be supposed, the foetal union is delayed to maturity in other respects, as in a specimen from Orizava, Mex., of 16.5 l. in length. Here the union is about as extensive as in *Ædipus morio*. In the young of *Thorius pennatulus* the digits are not distinguished in specimens of .66, the full size, and otherwise entirely mature. In the adult they are distinct for half their length. The digits in the young larva of *Gyrinophilus salmonensis* are as distinct as in those of *Spelerpes rubra*; in one example I find the simple foot of earlier stages retained, resembling exactly that of *Ædipus*, excepting that there are emarginations for but three toes, instead of five. Genera which have no premaxillary fontanelle at maturity have it in the larval stage. Finally closely allied genera, which only differ in the degree of ossification of the parietal and palatine bones, represent simply the relation between undeveloped and developed conditions of the same form.

The relations of the genera may be expressed as follows: Those of the first or *Plethodontine* section are related to those of the second or *Spelerpine*, by an *inexact parallelism*, excepting *Anaides*, whose peculiarities exclude it from the comparison. Those in each section differing in the union or separation of the premaxillary bones, are related in the same way to each other. The nearly allied genera in the *Plethodontine* group are *Hemidactylum* and *Plethodon*, and *Batrachoseps* and *Stereochila*. In the first case we have only *inexact parallelism*, because while *Plethodon* has the four digits of *Hemidactylum*, its parietal bones are unossified, though an acceleration of development in this respect would render the relation one of *exact parallelism*. This is apparently the relation between *Batrachoseps* and *Stereochilus*, for with the foetal digits of the latter, the former preserves also its foetal cranium. It only remains to ascertain whether *Stereochilus* loses its foetal condition or after acquiring the

species of the same genus. Thus in *Spelerpes rubra* they are entirely distinct at a very early period of larval life, while in *S. cephalicus* and *S. bellii*, which much more nearly resemble the species of *Ædipus* in the disposition of the vomerine teeth and cylindric form of the tail, this separation is much retarded.

These genera may be parallelized also in the following manner, in illustration of the law of heterology :\*

Plethodontæ.		Spelerpeæ.
	A. one premaxillary. No fontanelle.	
<i>Stereochila.</i>		* *
	A. fontanelle. Toes 4—5. Teeth large.	
<i>Anaides.</i>		* *
* *	Teeth small.	
	Toes 4—4.	<i>Spelerpes.</i>
<i>Batrachoseps.</i>		<i>Manculus.</i>
<i>Hemidactylum.</i>	AA. Two premaxillaries. Toes free.	
<i>Plethodon.</i>		<i>Gyrinophilus.</i>
* *	Toes united.	<i>Geotriton.</i>

The minor relations may be more readily expressed thus :

Plethodontæ.		Spelerpeæ.
	Digits 4—5.	
	A. Digits distinct.	
<i>Plethodon.</i>	Two premax.	<i>Gyrinophilus.</i>
<i>Anaides.</i>	One premax.	<i>Spelerpes.</i>
* *	A. Digits united.	
* *	Two premax.	<i>Geotriton.</i>
	One premax.	<i>Ædipus.</i>
<i>Hemidactylum.</i>	Digits 4—4.	<i>Manculus.</i>
<i>Batrachoseps.</i>		
Or thus :		one premaxillary.
two premaxillaries ;	Digits 4—5.	
	a. distinct.	
	Tongue free.	<i>Spelerpes.</i>
<i>Gyrinophilus.</i>		
	Tongue attached.	<i>Stereochila.</i>
<i>Plethodon.</i>		
	aa. united.	<i>Ædipus.</i>
<i>Geotriton.</i>		
	Digits 4—4.	<i>Manculus.</i>
<i>Hemidactylum.</i>		<i>Batrachoseps.</i>
* *		

The above genera present, within restricted limits, not only the relations which will be found to characterize genera elsewhere, but the relations between all natural groups of whatever rank, or in other words, between groups defined by structural peculiarities. From such simple cases we may derive the following rationale of classification with reference to characters above the specific : First,

\*See origin of Genera, p. 53.

those characters are highest which cover the greatest number of cases, (i. e. of species.) Second, the extent covered by each of a given number of characters being equal or nearly so, that is highest which expresses modifications of those characters which distinguish the group which embraces them all, from other groups of similar high rank. Third, the lowest grade of characters, except the specific, i. e. those which distinguish nearest allies, are always those which are assumed latest in the life history of each.

These rules are without significance if they do not point to a derivative hypothesis.

#### BATRACHOSEPS Bonap.

Tongue adherent anteriorly. Digits 4—4. A large parietal fontanelle. Premaxillary pierced by a fontanelle, single.

This genus embraces the forms which may be considered the lowest in the family, if *Necturus* be excluded. It differs from *Hemidactylium* nearly as *Opheobatrachus* does from *Spelerpes*, i. e., in the non-ossification of the parietal bones. This low grade of development is here seen in the extremities also, which are much reduced, and the snake-like form of one of the species. The species are three, as follows:

I. Costal plicæ 18; the toes well developed, palmate.

Outer posterior toe well developed; hind limb extending over 7-8 costal interspaces, fore limb to orbit; tail equal body and head to orbit, more slender than the body; belly yellowish.....*B. pacificus*.

II. Costal plicæ 20—1; toes very rudimental, little distinct.

Hind limb extending over six costal interspaces; fore limb nearly to orbit; tail as long as body and head to orbit; width of head seven times from muzzle to groin; belly black.....*B. nigriventris*.

Hind limb extending over four costal interspaces; fore limb not to angle of mouth; tail thick as body, as long as body and head plus the length from muzzle to axilla; width of head eight times from muzzle to groin; belly brown.  
*B. attenuatus*.

#### BATRACHOSEPS NIGRIVENTRIS Cope.

This small species resembles the first in general proportions, but is nearer the next in the rudimental condition of the limbs.

Muzzle shorter than orbit; upper lip slightly angulated. A groove from the orbit posteriorly; a gular fold. Costal grooves extending to vertebral line, but not curved forwards there as in *H. scutatum*; extending across abdomen. Body slightly compressed. The tail as stout as the body at the base, subquadrate in section, becoming compressed at the tip, strongly annulate, not swollen. Inner digits on both feet minute. Vomerine series well developed; sphenoidals as in the others.

**BATRACHOSEPS PACIFICUS** Cope.

*Hemidactylum pacificum* Cope, Proceed. Acad. Nat. Sciences, Phila. 1865, p. 195.

### HEMIDACTYLIUM Tschudi.

Classif. der Batrachier Trans. Neuchatel, 1838, p. 54—94. Bonap., Fauna Ital. ii, 131, No. 10. Fitzinger, Syst. Rept. 33. Baird, Journ. Ac. Nat. Sci. Phila. i, 284, 1849. Hallowell, l. c. 1858, 365. Gray, Cat. Brit. Mus. 1850, 41. *Desmodactylus* Dum. Bibr. Erp. Gen. 8 p.

Tongue adherent anteriorly. Digits 4—4. Parietal bones fully ossified, without fontanelle. Two premaxillaries, with fontanelle.

This genus is only distinguished from *Plethodon* by the deficiency of its hind foot in digits. Those that remain are quite rudimental. There is but one species known, and its habits are entirely terrestrial.

**HEMIDACTYLIUM SCUTATUM** Schlegel.

*Salamandra scutata* Schlegel, Mus. Leyd. Abbildungen, t. 40, f. 4, 6, 1837. Fauna Japonica, ii, 119. *Hemidactylum scutatum* Tschudi l. c., Bonaparte l. c., Baird, Hallowell, Gray l. c. *Salamandra melanosticta* Gibbes, Bost. Journ. Nat. Hist. v, 89, t. 10. *Desmodactylus melanostictus* Dum., Bibr., viii. *Salamandra fusca* Green, Journ. A. N. Sci. Phil. i, 337, 1818, not *S. fusca* Raf.

### PLETHODON Tschudi.

System d. Batrachier Trans. Neuchatel, 1838, 59—92. Bonap., Fauna Italica, ii, 131. Baird, Journ. Ac. N. Sci. Phil. i, 292. Hallowell, ib. 1858, 342. Cope, Proc. A. N. Sci. Phil. 1859, 124.

Tongue attached by the median line below, from the glossohyal bone to near the anterior margin; pterygoid teeth in two patches, more or less approximated; a large fontanelle between the spines of the separate premaxillary bones. Toes 4—5, normal. Anterior teeth not enlarged. Cranium well ossified. Two premaxillary bones, their spines embracing a fontanelle.

This genus is highly characteristic of the Regio Nearctica, where three species represent it on the Pacific slope, and two in the Eastern district. A species from Japan, named *P. persimilis* by Gray, is shown by Mivart not to belong to this genus.\* The species are all terrestrial in their habits, and three which I have observed (*P. oregonensis*, *P. glutinosus*, *P. erythronotus*) undergo their metamorphosis while quite small. The last named, and probably *P. glutinosus*, never enter the water, but are hatched in damp places on land. The branchiæ have therefore no functional service.

*a.* The pterygoid patches in contact throughout; vomerine series well separated medially.

Costal plicæ 16 to 19; form slender, tail cylindric, limbs weak, inner toes rudimental; vomerine series not extending beyond nares externally; belly brown marbled; above plumbeous or with a red longitudinal band.

*P. erythronotus.*

Costal plicæ 13; form slender, tail well compressed; limbs weak, inner toes rudimental; vomerine series not extending outside of nares; belly brown marbled; above with a red dorsal band.....*P. intermedius.*

Costal plicæ 14; form stout, tail rounded; limbs short, stout; inner digits distinct; vomerine series extending outside of inner nares; black, usually with gray lateral blotches and smaller dorsal spots.....*P. glutinosus.*

*aa.* The pterygoid patches well separated, vomerine series closely approximated medially.

---

\* Mivart calls it *Pectoglossa*, but gives no character by which it can be separated from *Amblystoma*.

Costal plicæ 13; form stout, head large, wide; lower jaw wider than upper; muzzle broadly truncate; tail slender subcylindric; black, limbs, belly, and spots of back, orange.....*P. croceatus*.

Costal plicæ 10—11; form stout, head wide, maxillaries wider than mandible; muzzle narrowly truncate; tail slender, subcylindrical; light brown above; limbs and below yellow.....*P. oregonensis*.

**PLETHODON ERYTHRONOTUS** Green.

Var. *a. cinereus*.

Sal. c. (Sept. 1818) Green, J. A. N. S. i. 356.

*P. c.* (1838) Tsch., Class. der Bat. Baird, Journ. A. N. Sci. (2) 1 p.

Var. *β. erythronotus*.

Sal. c. (Sept. 1818) Green, J. A. N. S. i. 356. (1838) Holb. Herp. III. 12, pl. 27. (1842) 2d ed. v. 43, pl. 11. (1840) Storer, Mass. Rept. 245. (1842) Dekay, N. Y. Rept. 75, pl. 16, f. 38.

*Plethodon erythronotus* Baird l. c., Hallowell l. c., 1858, 343.

N.B.—Green quotes this species from Raf., whose description I cannot find.

Var. *γ. dorsalis*, Baird, M. S.

3776. Louisville, Ky.; Salem, Mass.

**PLETHODON INTERMEDIUS** Baird.

Proceedings Acad. Nat. Sci. Phila. 1857, 209.

Vancouver I.

**PLETHODON GLUTINOSUS** Green.

Sal. g. (Sept. 1818) Green, J. A. N. S. i. 357. (1838) Hol. Herp. 1st ed. ii, 129, pl. 30. (1842) 2d ed. v. 39, pl. 10?? (1849) Storer, Mass. Rept. 259, an. A. Jeffersoniana? (1842) Dekay N. Y. Rept. 81, pl. 17, f. 43 (very young).

Sal. variolata, (Dec. 1818) Gilliams, J. A. N. S. i. 460, p. 18, f. 1.

Sal. cylindracea, (Nov. 1825) Harl., J. A. N. S. v. 156.

*Triton porphyriticus*, (1842) Dekay, N. Y. Rept. 83, pl. 16, f. 37.

*P. g.* (1838) Tschudi, Class. der Bat.

Whole eastern district R. nearctica.

**PLETHODON OREGONENSIS** Girard.

*Heredia oregonensis* Girard, Proc. Acad. Nat. Sci. Phila. viii, 1856, 235. Girard, U. S. Expl. Ex. Herpet. 1858, 11. Hallowell, Pr. A. N. S. Phil. viii, 1856, 235.

*Plethodon insatus* Cope, Proc. Acad. Nat. Sci. Phil. 1867, 167, a *Triton insatus* Esch. = *Ensatina eschscholtzii* Gray = *Heredia oregonensis* Girard sde Mivart nec Eschscholtzii species!

Costal plicæ 17; elongate, head narrow, width more than seven times to groin, more than twice to axilla; no canthus rostralis; tail compressed from base, finned; small; pale yellow, brown lined.....*S. marginatum*.

**STEREOCHILUS MARGINATUM** Hallowell.

*Pseudotriton marginatus* Hallowell, Proceedings Ac. Nat. Sci. Phila. 1856, p. 130.

#### MANCULUS Cope.

Tongue free all round, boletoid. Toes 4—4. Parietal bones ossified, and without fontanelle. Premaxillaries co-ossified.

This genus only differs from *Spelerpes* in the absence of a digit from the hind foot, standing thus in the same relation to it that *Hemidactylum* does to *Plethodon*. Its only species was formerly referred to *Batrachoseps*, but besides the great difference in the tongue, the latter has a parietal fontanelle and lacks the prefrontal bone. The latter point is indicated by Eschscholtz in his Atlas. In the present genus that bone is present.

But one species is as yet known, which has a limited distribution. It is the smallest North American Salamander.

**MANCULUS QUADRIDIGITATUS** Holbrook.

*Salamandra quadridigitata* Holbrook, N. Amer. Herpetology, 2d ed. v, 65, tab. 21. *Batrachoseps quadridigitatus* Baird, J. A. N. Sci. Phila. 1842, p. 287; Gray, Catal. Brit. Museum, 1850; Hallowell, J. A. N. S. Phil. 1858, p. 348.

South East Georgia.

#### OPHEOBATRACHUS Gray.

Annals and Magazine Nat. Hist. 1868, p. 297. *Spelerpes* Spec. Cope, 1865. *Ædipina* Keferstein, Archiv. fur Naturgeschichte, 1868, 299.

This genus differs from *Spelerpes* in the larval character of the cranium; its diagnosis is as follows:

Tongue free all round, boletoid. Digits 4—5, very short, distinct. Sphenoidal series of teeth not united. Cranium membranous above, parietal bones separated, scale-like. Internal nares enclosed except at the external fissure.

Gray gives the generic name to the *O. vermicularis*, on account of its remarkable vermiform shape. This is, however, among animals with reduced limbs, always a more or less variable character, and when constant in a species is certainly not of higher value. The relative elongation of the body and tail is a marked specific character in *Amblystoma*, *Plethodon* and *Spelerpes*, and in many Lacertilian genera, e. g. *Gerrhonotus*. It distinguishes species otherwise nearly identical, and in some cases, as in *G. multicarinatus*, mere varieties of the same species.

The species of this genus are very similar to those of *Spelerpes* in all respects; the difference is not quite the same as that between *Batrachoseps* and *Hemidactylum*. They are weak and of small size. The type species are distinguished by elongate tails. None are known outside of the Mexican zoological district, in the broad sense.

The generic characters were first indicated by the writer in the Journ. A. N. Sci. Phila. 1866, p. 100.

Costal plicæ fourteen..... *O. lineolus*.

Costal plicæ nineteen..... *O. vermicularis*.

**OPHEOBATRACHUS LINEOLUS** Cope,

*Spelerpes lineolus* Cope, Proc. Ac. Nat. Sci. Phil. 1865, 196.

*Char.* Fourteen costal plicæ; vomerine teeth in long series, extending behind internal nares; tail twice as long as head and body, cylindric. Three median toes, subequal.

Though the carpus and tarsus in this species are cartilaginous, the representation 1869.]

sentatives of the bones present in the osseous types (*Amblystoma* and others) are developed as they are in many other species of this family. The phalanges are 1—2—2—2—1 on the feet. The metatarsals are not fully ossified medially.

From Eastern Mexico.

*OPHEODACTYLUS VERMICULARIS* Gray.

Annals and Magazine Nat. History, 1868, p. 297. *Cedipus uniformis* Keferst., Archiv. f. Naturgesch. 1868, 299.

I had formerly supposed this species to be the same as the preceding, till I read Dr. Keferstein's description, where the specific characters are for the first time pointed out.

Guatemala, Costa Rica.

### GEOTRITON Gené.

Bonaparte, Fauna Italica, t. 31. No. 14.

Tongue attached by the glossohyal pedicel only. Two premaxillary bones, which embrace a fontanelle; parietals ossified, palatines well developed. Digits 4—5, united, extensively connected by membrane.

But one species of this genus is known, which is interesting as being the only species of the *Plethodontidae* which occurs in Europe. Its characters are quite identical with the *Cedipus* of the warmer parts of America, except in respect to the distinction of the two premaxillary bones, which are consolidated in *Cedipus*. Until I determined the existence of this character, I regarded the latter name as a synonyme of *Geotriton*.

a. Two phalanges, free.

Costal plicæ ten; head wide, width less than five times to groin; parasphenoid patches widely separated from vomerine teeth; pale brown above.

*G. fuscus*.

*GEOTRITON FUSCUS* Gesner.

*Salamandra fusca* Gesner. *S. savii* Gosse. *S. genei* Schlegel. *Geotriton genei* Tsch. *G. fusca* Bonap.

Sardinia.

### CEDIPUS Gray

Catal. Batr. Sal. Mus. Britt. 1850, 47, num *Tschudii*, *Bonapartii et aliorum*?

Tongue attached only at the glossohyal pedicel; digits 4—5, united by a broad dermal expansion, the phalanges little ossified. Premaxillary bones ankylosed and embracing a fontanelle. Parietal bones well ossified.

black below, dorsal region yellow to orbits, with black spots; sometimes forming a median band.....*O. carbonarius*.

" Body short, stout; plicæ?; head width more than one-sixth length to groin; black, with pale specks, which may form series or not" (Peters).

*O. adpersus*.

Body short, stout; twelve costal plicæ; vomerine series commencing within inner nares; width of head less than five times in length to groin; black above; brown, white speckled below.....*O. rufescens*.

#### *ÆSOPUS MORIO* Cope.

*Geotriton carbonarius* (black variety) Cope, Proc. Ac. Nat. Sci. Phila. 1868, 313.

This species is near the *G. carbonarius*, and differs almost entirely in its free terminal phalanges, shorter body, and in coloration.

The muzzle is slightly truncate and the head flat, and not so wide as in *G. fuscus*; its width enters the length to the groin 5.33 times, indicating a shorter body than in *O. carbonarius*. The plicæ of the sides are, however, equal in number and well marked. Similar folds mark the sides of the tail. Those behind the eye are similar to those of *G. fuscus*, but less marked. The vomerine series are well arched, and nearly meet medially; they are nearly approached by the prolonged point of the parasphenoid patches, which together form a triangle, with the (posterior) basal angles rounded. The patches are separated by a groove for only about half their length. The distances between inner and outer nares are the same. The end of the muzzle projects beyond the mandible.

The limbs appressed leave two intercostal intervals between them. The inner toe is not free on either foot; one phalange of the others is free, except the median, where  $1\frac{1}{2}$  phalanges project. The free termination has a rounded thickening below.

Tail thickened, round, tapering.

Color. Black above; leaden black below; the under surfaces and lower parts of sides, with outer faces of limbs, speckled with indistinct whitish dots.

#### Measurements. No.

	Inches.
Length (axial) from end muzzle to orbit.....	.105
" " " canthus oris.....	.22
" " " axilla.....	.63
" " " groin.....	1.66
" " " end vent.....	1.94
" " " end tail.....	3.29
" fore limb.....	.45
" " foot.....	.145
" hind limb.....	.45
" " foot.....	.17
Width " " (sole).....	.17
" head.....	.28
" body.....	.28
" sacrum.....	.22

The only specimen I have seen is the following:

No. 6553, 1 specimen, Mountains of Guatemala, Dr. Van Patten.

#### *ÆSOPUS CARBONARIUS* Cope.

Proceed. Ac. Nat. Sci. Phila. 1860, p. 373.

? "*Salamandra platydactyla* Cuvier, Mus. Paris," not described.

? "*Ælipus platydactylus* Tschudi, Classif. der Batrachier, p. 93, 1838, not described.

*Bolitoglossa Mexicana* Dumeril, Erp. Gen. vol. ix, p. 93, 1854 (specimens from Vera Paz) pl. 105, fig. 1.

1869.]

**ÆDIPUS ADSPERSUS** Peters.

*Ædipus adpersus* Monatsberichte, Acad. Wiss. Berlin, 1863, 466. *Geotriton* do. Cope, Pr. A. N. Sci. Phil. 1865, 196.

*Habitat.* Near Bogota, New Grenada.

Interesting as the most southern of the American salamanders.

**ÆDIPUS RUFESCENS** Cope.

Sp. nov.

This species is near the *G. carbonarius*, but is notably more abbreviated, and has a different coloration. The vomerine series is shorter, and there is a lateral plica less.

Muzzle truncate with prominent subnasal projections; its length 1.5 line, the width between anterior canthus of eyes. Appressed limbs, separated by two and a half costal spaces. Plicæ eleven, with a twelfth indistinct axillary fold. Width of head 5.4 in length to groin. Tail short, thickened, cylindric, equal from end vent to shoulder.

The vomerine do not extend outside of the inner nares, and nearly meet. The paraspheoïds are as in other species, in two approximate patches, narrowing in front and but little divided behind.

*Color.* Sides and above black, the back and top of head with a rufous cast. Under surfaces brown, white specked.

	Inch.
Length to axilla.....	.59
" groin .....	1.04
" end tail .....	.82
" fore limb.....	.26
" hind " .....	.26

From Vera Cruz, Mexico.

No. 6886, 1 specimen, Orizava, Mexico, F. Sumichrast.

The *Ædipus variegatus* Gray, Catal. Brit. Mus. p. 48, may belong to this genus, or even to one of the species here described—as the present one. It is described in the following language: "Yellow brown, with three irregular slightly inosculatory dorsal streaks." Gray.

**SPELERPES**, Rafinesque.

Atlantic Journal, i, p. 22, 1832. *Cylindrosoma* Tachudi, Nat. Syst. Batrachier Neuchatel, 1838. *Cylindrosoma* et *Bolitoglossa*, pars Duméril Erp. Gen. ix. *Spelerpes* et *Pseudotriton* Baird, J. A. N. Sci. i; Hallowell l. c., iv. *Spelerpes* Gray, Catal. B. M. 1850, 43.

The tongue free, except at the glossobyal support. Palatine and parietal bones fully ossified. Premaxillaries consolidated, and their spines embracing

Plicæ 12; inner toe and joint distinct, other toes well developed, cylindric; width head 5 to 6 times head to axilla, 2.5 to 3 times to groin; tail generally more elongate; black, sides, tail, and often back, grey varied; larger.

*S. leprosus.*

Plicæ 11; inner toe not distinct, other toes very short, margined; width of head 4 2-5 to axilla, 1-3 to groin; tail short; black, unspotted; medium.

*S. cephalicus.*

II. Vomerine teeth not continued posteriorly to the pterygoid patches, nor exteriorly to beyond the nares.

a. Tail round, costal grooves 11—12, inner toes rudimental.

Plicæ 11 (without inguinal); width of head 4.5 length to axilla, 2.5-6 times in length to groin; tail rather short; upper lip more or less truncate and angulate.....*S. chiropterus.*

aa. Tail subround, costal grooves 21, inner toes minute.

Width of head near 1-7 length to axilla, .33 of length to groin; limbs short; tail thick at base; brown, dorsal region darker; small.

*S. multiplicatus.*

aaa. Tail compressed, costal grooves 13—14, inner toes longer.

Plicæ usually 14; width of head less than one-sixth to groin; head to axilla well over .33 of the same; body longer, tail not keeled above proximally, comparatively short, vomerine series turned obliquely backwards. Yellow, with two latero-dorsal black lines; tail dark laterally; belly immaculate; small.....*S. bilineatus.*

Plicæ 13; width of head equal one-sixth length to groin; muzzle to axilla more than one-third the same; tail long, keeled above. Yellow, sides many black spotted, a median dorsal series of spots; tail yellow, black barred; belly immaculate; large.....*S. longicaudus.*

Plicæ 13; width of head greater than one-sixth length to groin; from muzzle to axilla considerably more than .33 length to groin; tail long, keeled above. Yellow, with three black bands; tail black, yellow barred; belly mottled; large.....*S. guttolineatus.*

III. Vomerine series of teeth continuous posteriorly, with the pterygoid brushes, and originating behind nares.

Costal plicæ 15—16; head wide, not more than seven times to groin, not more than twice to axilla; no canthus rostralis; tail rounded at base, not fanned; large; vermillion red, black or brown spotted.....*S. ruber.*

*SPILERPES BELLII* Gray.

Catalogue British Museum, p. 46. Cope, Proc. Acad. N. Sci. Phil. 1860, 372. (*Edipus platydactylus* "Tsch." Baird, Journ. Acad. Nat. Sci. Phila. 1850, pp. 282, 286. *Bolitoglossa Mexicana* Duméril, Bibron Erp. Gen. ix, 93, 1854 (exclus. synonymy).

North Eastern Mexico.

*SPILERPES LEPROSUS* Cope.

Species nova.

This salamander is one of the numerous additions made to herpetology by Samichrast's explorations in the mountains of Eastern Mexico. Of the seven species of *Urodeles* which he found in that region, this appears to be the third in size; it approaches in this respect, and in some degree in coloration, the *Plethodon glutinosus*.

The form is stout, the head broad with short muzzle, and the tail cylindric and glandular; it is not unfrequently swollen at the base. In the largest specimens, selected as the stoutest, the length of the head from the postorbital line is only 3-5 the width at the same point. The fore limb extended reaches to the posterior margin, or to the middle of the orbit, for in extreme speci-

1869.]

mens there is a difference in the degree of elongation of the body to the following amount: In the stouter, the length to axilla enters  $2\frac{1}{2}$  to groin; in the more slender  $2\frac{1}{2}$ ; in the former the width of head goes 5 times in length to groin; in the latter 6.25 times. There is no axillary costal fold; the inguinal is not marked; the plicæ do not extend on the back (where there is a faint median groove), but are distinct on the belly; tail annulate. The feet are very wide and the toes short, but not so much so as in *S. cephalicus*. The inner digit is developed on both feet, though short, especially the posterior; the outer is also larger than in the species just named. The toes are thickened at the extremities. The hind limb extends over 6.5 intercostal spaces from groin. The gular fold is well marked, while the longitudinal post-orbital groove is not or scarcely visible. The upper lip is slightly truncate, and with small subnasal angles.

The color is black as a ground, less obscured below, where it, however, varies to brown. The gular region splotted or speckled with gray.

The sides of the body with the tail are splotted lichen-like with light gray, the same sometimes covering the dorsal region. In one specimen there is a pale red dorsal band. Head black.

*Measurements.*

No. 6340, Type.

	Inches.
Length from snout to gape.....	.18
"    "    axilla.....	.59
"    "    groin.....	1.75
"    "    end vent.....	2.
"    "    " tail.....	3.6
forelimb.....	.42
" foot.....	.12
hind limb.....	.433
" foot.....	.16
Width head.....	.3
" body at sacrum.....	.18

Like other Mexican *Spelerpes* this animal seems to pass its metamorphoses early; a young one sent with the adults measures 21 lines in length. The largest specimen measures 4.4 inches.

This species, according to Sumichrast, is confined to the Alpine region, in Vera Cruz, Mexico. In life, the light tints are of a pale yellow.

No. 6340, 6 specimens, Orizava, Mexico, Pr. Fr. Sumichrast.

*SPELERPES CEPHALICUS* Cope

*Rept. Acad. Nat. Sci. Phila.* 1884, p. 222.



the smallest specimen the terminal .75 above and .33 below are keeled; in others the superior keel is more distal.

Upper lip moderately truncate, with infra-nareal angles, and in one, rudimental cirri. The muzzle is rather thick and short, the head flat; in one smaller specimen the former is a little longer than in the others, and the width of the head relatively less. The vomerine teeth form short series, each rather suddenly bent backwards; the pterygoids two narrow patches, not approaching the vomerines, the relations in this respect being as in *S. bilineatus*.

The color in four specimens is an unspotted brown, the inferior surfaces paler, especially the gular region. In the smaller specimen above mentioned, which seems to constitute a variety, the brown color forms a broad dorsal band, with dark points; the sides are of a pinkish gray, and the under surfaces light yellow.

Measurements of the largest specimen, on the axis of the body:

	Inches.
Length from muzzle to orbit .....	.05
" " rictus .....	.12
" " axilla .....	.425
" " groin .....	1.53
" " end of tail .....	3.24
" of fore limb .....	2.33
" " foot .....	.08
" hind limb .....	.29
" " foot .....	.133
Width head at anterior angle orbits .....	.1
" " rictus .....	.22
" body at sacrum .....	.15

The form of this species would indicate it to be terrestrial in its habits. Of its geographical range we have as yet little information.

No. 4038, 5 specimens, Red River, Arkansas, Dr. L. A. Edwards.

#### *SPELERPES BILINEATUS* Green.

*Salamandra bilineata* Green, J. A. N. S. i, 352, 1818; Holbrook, Herpetology, 1st ed. ii, 127, tab. 29—2d ed. v, 55, pl. 16, 1842. *Salamandra flavissima* Harlan, Sill. Journ. x, 286, 1826. *Spelerpes bilineata* Baird, Journ. A. N. S. i, 287; Gray, Catal. Brit. Mus. 44, 1850; Hallowell, Journ. A. N. Sci. (2) iv, 346. *Salamandra corrigera* Green, Journ. A. N. Sci. iv, 253; Harlan, Med. Phys. Res. 99. *Spelerpes corrigera* Baird, J. A. N. Sci. i, 287; Gray, Cat. B. M. 44; Hallowell l. c. iv, 347.

*Habitat*.—From Maine to Wisconsin, to Florida and Louisiana.

#### *SPELERPES LONGICAUDUS* Green.

*Sil. l.* (Sept. 1818) Green, J. A. N. S. i, 351; (1838) Hol. Herp. 1st ed. iii, 111 pl. 26; (1842) 2d ed. v. 61, pl. 19; (1842) Dekay, N. Y. Rept. 78, pl. 17, fig. 41.

*Spelerpes lucifuga* (1832) Raf., Atlantic Journal, No. 1, p. 22.

*Cynndrosoma longicauda* (1838) Tsch., Class. der Bat.

*Spelerpes longicauda* Baird, J. A. N. S. (2) i, 287; Hallowell l. c., 345; Gray l. c. 43.

*Habitat*.—Same as the last species.

#### *SPELERPES GUTTOLINEATUS* Holbrook.

*Salamandra guttolineata* Holbrook, Amer. Herpetol. 1st ed. ii, 61, t. 12—2d ed. v. 29, t. 7. *Spelerpes guttolineata* Baird l. c., 287; Gray l. c. 45; Hallowell l. c. 345.

*Habitat*.—South Carolina, Georgia. Alabama.

#### *SPELERPES RUBER* Daudin.

*Sal. rubra* (1803) Daud., Hist. Rept. viii, 227, pl. 97, f. 2; (1842) Holb. Herp. 2d ed. v. 35, pl. 9; (1842) Dekay, N. Y. Rept. 80, pl. 17, f. 43.

1869.]

*Sal. rubriventris* (Sept. 1818) Green, J. A. N. S. i, 353 (ad. living).

*Sal. maculata* (Sept. 1818) Green, J. A. N. S. i, 350 (bleached in spirits).

*Sal. subfusca* (Sept. 1818) Green, J. A. N. S. i, 351 (ad. in spirits?)

*Pseudotriton subfuscus* (1838) Tsch., Class.

*Myxoglossa ruber* Bibron fide Bon. Fauna Italica.

*Siren operculata* (1796) Pal de Beauv. Am. Phil. Trans. iv, 279, pl. —, f. 3 (larva).

*Proteus neocensariensis* (Sept. 1818) Green, J. A. N. S. i, 358 (larva bleached in spirits).

*Pseudotriton ruber* Baird, Journ. A. N. Sci. Phil. i, 286; Hallowell l. c., 347.

*Spelerpes ruber* Gray, Cat. B. M. 1850, 45.

There are several varieties of this species, which, though quite distinct, pass into each other:

Var. *P. r. sticticeps* Baird, S. Carolina.

Var. *P. r. flavissimus* Hallowell; *Pseudotriton flavissimus* Hallowell, Proceed. A. N. Sci. Phil. 1850, 130, Georgia.

Var. *P. r. montanus* Baird; *Pseudotriton montanus* Baird, Journ. A. N. S. i, 287—293; Gray l. c., 46. The Allegheny Mountain region from Pennsylvania to S. Carolina.

*Habitat*.—The *Spelerpes ruber* is distributed over the Eastern district of North America from Maine to Minnesota, and to Texas and Florida.

#### GYRINOPHILUS Cope.

Tongue supported only by the glossohyal pedicel, boletoid; cranium fully ossified, the premaxillary bones remaining distinct, and embracing a fontanelle. Digits entirely distinct, 4—5.

This genus is now first distinguished from *Spelerpes*, on account of the marked peculiarity of the premaxillary bone, in which it resembles *Plethodon* rather than the first named. But one species is as yet known. It has a superficial resemblance to the *Spelerpes ruber*, but differs in several osteological peculiarities. Its nasal bones are well separated, and the preotic squamosal crests are peculiar. The anterior or preotic crest is short, distinct and curved inwards and backwards; that on the proximal extremity of the squamosal curves towards it, but leaves a considerable interspace. This is occupied by two osseous processes like two teeth of a comb. In *S. ruber* the anterior crest only is present, and forms a rectangle, the anterior limb being transverse, and the angle inwards. The nasal bones also are in contact across the premaxillary spines.

The type of the genus remains for a more than usually long period in the larval condition, and just before its metamorphosis is quite identical in its

is not indicated by Green's description. It is not so large, has not the canthus rostralis, the larva is very small, and the coloration is quite different. Green's figure represents it well, though the *Amblystoma jeffersonianum*, on the same plate, is represented as larger, a relation of size, the reverse of what usually holds in nature.

This is the only one of our eastern Salamanders which attempts self defence. It snaps fiercely but harmlessly, and throws its body into contortions in terror. It prefers the coolest localities throughout the Alleghany Mountain region from New York to Alabama. It is aquatic, but prefers the still waters of swamps or springs to running streams. It is common in the region whence Green procured it, while *A. microstomum* is rare if existing at all.

#### ANAIDES Baird.

Iconographic Encyclopædia, ii, 1849, 256. Girard, United States Expl. Exped. Herpetology p. 8, tab. i, f. 18—25.

Tongue attached from glossohyal to anterior margin, on the median line; considerably free. One premaxillary bone. Pterygoid teeth on a single plate. Vomerine teeth on a ridge which is continuous between the interior nares. Maxillary teeth\* longer on the anterior than posterior part of the arch, compressed, knife-shaped, with entire enamel; mandibular teeth of similar form and large development, few in number, and confined to the anterior half of the ramus. Toes 4—5, obtuse and slightly dilated at tip.

This curious genus is furnished with by far the most powerful dentition of any existing Salamander, and resembles in this respect the genera of the coal measures, *Brachydectes*, *Hylerpeton* and *Hylonomus*. In other points there is little difference between it and *Plethodon*. One marked feature brings it nearer *Desmognathus* than any other genus of *Plethodontidæ*. The episthetics are each furnished with a high longitudinal crest over which the temporal muscle passes from its origin on the atlas. It has, however, the usual origin from the median line of the parietals, which scarcely exists in *Desmognathus*. This line is marked in *A. lugubris* by an elevated crest. The end of the muzzle in that species bears evidence to a habit similar to that which accompanies the singular structures of *Desmognathus*, viz., that of burrowing or rooting among stones or other resisting objects. The derm is similarly adherent to the bone, and the latter is exostosed and rugous. The prefrontal bones are well developed.

No species has yet been found east of the Californian or Pacific Coast region.

Large, stout; thumb developed, fingers short; pterygoid series narrow, vomerines strongly curved backwards; width of head 4.5 to groin; light brown above, with yellow spots..... *A. lugubris*.

Smaller, slender; thumb not distinct, fingers long, slender; pterygoid series wider, vomerine series scarcely recurved; width of head 6.33 times in length to groin..... *A. ferreus*.

#### ANAIDES LUGUBRIS Hallow.

*Salamandra lugubris* Hallow., Proceed. Acad. Nat. Sci. Phila. iv, 1848, 126. *Anaides lugubris*, Baird, Iconogr. Encycl. ii, (1st ed.), 1849, 256; B. and G. in Proc. Acad. Nat. Sci. Philada. vi, 1853, 302. *Taricha lugubris* Gray, Catal. Amph. Brit. Mus. Parts ii, 1850, 26.

*Habitat*.—California from Ft. Tejon to Oregon.

#### ANAIDES FERREUS Cope.

Spec. Nov.

This is a smaller and more slender species than the last, not being very

\* Girard l. c. describes the teeth as not fixed to the jaw, and capable "of a depression backwards." This is only true of successional teeth, or teeth about to be shed; the functional teeth are firmly ankylosed.

different in proportions from *Plethodon intermedius*, but with a broader and more flattened head.

The head is an elongate oval, slightly truncate in front; the nostrils are antero-lateral, and with a delicate groove connecting with the commissure of the mouth. Canthus rostralis not marked. The muzzle is as long as the fissure of the eye, while the length of the commissure of the mouth (diagonal line) is equal to the width of the head at the rictus. The tongue is largely free, the posterior portion rather narrowly. The inner nares are nearer together than the outer. The vomerine teeth commence behind the nares and form a single series of eight on a ridge, which is gently arched backwards on the median line. The parasphenoid patch does not extend quite forwards to the middle of the orbits; it is much flatter and wider anteriorly than in *A. lugubris*, and contains opposite the posterior margin of the orbits ten longitudinal series of teeth, those of adjacent rows alternating.

Gular fold well marked; costal folds fourteen, not continued on back or abdomen. The limbs, and especially the digits, are slender; appressed to the side they fail to meet by the length of the fingers. The form of the body is slender and cylindric, and the width of the head enters the total length of the groin seven times. The tail is as in *A. lugubris*, equal to the head and body in length, cylindrical, slender, and slightly compressed at tip.

The thumb possesses a short phalange, but no part of it is free as in *A. lugubris*; on the other hand, all the phalanges of the other toes of both feet are more slender than the *A. lugubris*, and the distal ones distinctly truncate and slightly emarginate, with dermal thickening below tip. All are quite free. Number of phalanges 1-2-3-2, 1-2-3-3-2.

*Coloration*.—Sides and nape greenish gray; top of head and dorsal region behind in the form of a serrate band, with the tail black; below yellowish brown. Limbs black above, brown below. Inferior regions unspotted.

*Measurements.*

	Inch.
Length (axial) from snout to rictus oris.....	.42
" " " axilla .....	.70
" " " groin.....	1.75
" " " end vent.....	2
" " " end tail.....	2.65
" fore limb.....	.5
" " foot .....	.3
" hind limb.....	.55
" " foot.....	.26
Width " " (sole).....	11

Vertebral opisthocœlian.

Carpus and tarsus osseous.

Dentigerous plates on the paraspheniod.

This family combines the peculiarities of the *Desmognathidæ*, *Plethodontidæ* and *Amblystomidæ* in a remarkable manner. The well developed opisthocœlian vertebræ are characteristic of the first named and of the *Salamandridæ*, the fully ossified tarsus and carpus of the *Amblystomidæ*. The dentition is entirely that of the *Plethodontidæ*. This was the less to have been anticipated, as the general characters of the only genus are those of the genus *Spelerpes*. The history of the metamorphosis is as yet unknown. The only known genus is Mexican.

#### THORIUS Cope.

Parietal and palatine bones rudimental, represented by cartilage and membrane. Posterior nares therefore not separated from orbit; sphenoidal patches of teeth entirely united; tongue boletoid, free in front. Toes distinct, rudimental, 4—5.

The tarsal bones consist of astragalus, calcaneum, a scaphoid and three minute cuneiform bones. The metatarsals and phalanges are fully ossified, as are the corresponding elements of the fore limbs.

This genus is highly interesting, as indicating the lowest grade of ossific deposit found among the tailed Batrachians, accompanied by characters of full development in other respects. Thus, while the cranium is but imperfectly ossified, and less developed than in a comparatively early larval stage of *Amblystoma*, the tongue, vertebral column, and extremities have advanced far beyond its larval condition, which is permanent in the latter genus, and the branchial apparatus disappears while the individuals are but little more than half their adult size.

It is represented as yet by but one species, from Mexico, of terrestrial habits.

#### THORIUS PENNATULUS Cope.

American Naturalist, 1869, 222.

This is a small species, with smooth skin, very weak limbs, and stout tail. The head is scarcely wider than the neck; it is not flattened, the loreal region is rather elevated and distinct, and the muzzle slightly prominent. The upper lip is sometimes truncate, with infranarial angle prominent, sometimes regularly rounded. The nostril is larger than any known salamander, its diameter equalling half that of the pupil.

The vomerine teeth are situated on a transverse, elevated crest, which is a little behind between the inner nares, and though curved backwards, is but little interrupted medially. Each half contains four teeth, perhaps five when complete. The sphenoidal series is large, pyriform, the anterior extremity narrowed and prolonged to opposite the middle of the orbits.

There are thirteen costal folds; three and one-half of their interspaces are covered by the extended hind limb, from its origin. The toes are very small; only the three median behind and three outer before are developed beyond the metatarsus. The phalanges are, anteriorly 0—2—2—1; posteriorly 0—2—2—2—0. Their extremities are distally free; that of the median posterior projects more beyond those adjacent than in *O. lineolus*. The costal plicæ are not marked on the dorsal, and only on the ventral in the color variety mentioned. The tail is stout, and for a short distance at the base subquadrate in section, and nearly as thick as the body; distally it is more compressed, but is not keeled; length equal to that of head and body. The width of the head enters 6.5 times, and the length in front of the axillæ 3.33 times the length to the groin.

The color is brown, yellowish and clouded below, the dorsal region covered with a gray band, which extends to the end of the tail. This band is particularly light and slightly metallic on its margins, which are undulate or serrate, 1869.]

and which are in strong contrast to the black of the lateral regions. The latter graduates into the brown of the belly. The gray dorsal band is marked by a number of short divergent spots, which are in pairs and open backwards, V-shaped, one to each costal interval. One specimen constitutes a color variety, as I find no other points of peculiarity. It differs in being nearly black above, in having the sides longitudinally streaked, and the gular region specked with white; a whitish incomplete triangle on the front and muzzle.

*Measurements (axial).*

No. 6341. Type ♀

	Inches.
Length from snout to rictus oris .....	·11
"    "    axilla .....	·3
"    "    groin .....	·868
"    "    end vent .....	1·016
"    "    " tail .....	1·95
Width head behind .....	·133
" body at sacrum .....	·133
Length fore limb .....	·14
" hind " .....	·17
" " foot .....	·05

The specimen measured is the largest; it contained numerous eggs in the oviducts, which have attained a diameter of a line, without indication of embryo. This size is remarkable when compared with that in the *Pleurodelidæ*, and other salamanders. As the body is little above six lines in length, the number discharged at any one time must be small. The smallest specimen measures ·6 inch from muzzle to groin, so that it appears that this species passes its metamorphosis quite early. F. Sumichrast, to whom we are indebted for this species, says of it:

No. 6341, 6 specimens, Orizava, Mexico, F. Sumichrast (No. 48).

No. 6744, 1 specimen, " " " " Color var.

*DESMOGNATHIDÆ.*

Cope, Journ. Acad. Nat. Sci. Phila. 1866, 107.

Prefrontals and pterygoids wanting.

Parietals not embracing frontals.

Orbitosphenoid separated by membrane from proötic.

Vestibule, internal wall osseous.

Dentigerous plates on the parasphenoid.

Carpus and tarsus cartilaginous.

nose at any late period, with the nasale; its ordinary position is traversed by the frontal suture. The frontal bone is decurved, and closes the preorbital aspect of the superpalatal vacuity, usually open.

This marked genus, so abundantly represented by individuals in the eastern district of North America, is not admitted by either Duméril or Hallowell, probably because it does not differ in external characters from *Plethodon*. It is an excellent illustration of the error of adhering to external characters only, in the explanations of the relations and affinities of organized beings, except for a limited range. The examination of the skeleton of species of this genus utterly changes the impressions produced by a consideration of the external characters. It may be stated as characteristic of the *Batrachia* in general, that their affinities cannot be determined without study of the skeleton.\*

There are no dermal appendages developed in this genus at the breeding season.

I. Males with posterior half mandible concave and edentulous.

Inferior lateral series of pores imperfect or wanting, superior none; no tubercle in canthus oculi. Tail rounded. Fourteen costal plicæ. A yellowish dorsal band; belly immaculate. Size small..... *D. ochrophæa*.

II. Males with mandibular alveolar margin continuous and completely toothed.

Inferior lateral series of pores well developed, superior irregular or wanting; a tubercle in canthus oculi; tail compressed, and keeled; fourteen costal plicæ. Above dark spotted, below marbled. Size medium.

*D. fusca*.

Two well developed lateral series of pores, a marked tubercle in the canthus of the eye; tail flattened, finned above, attenuate; twelve costal folds. Black above and below. Size large..... *D. nigra*.

*DEMIGNATHUS OCHROPHÆA* Cope.

Proceed. Acad. Nat. Sci. Phila. 1859, 122.

This small species bears a strong resemblance to the *Spelerpes bilineatus* Green, and apart from generic characters, may be known from it by the rounded tail, the paler colored abdomen, and the light bar from the eye to angle of the mouth. Its proportions are stouter than in *Plethodon erythronotus*, to which it also bears some resemblance.

The costal folds are thirteen, but fourteen, if that which is immediately above the groin be counted. The first falls immediately into the axilla. This is the characteristic arrangement in *D. fusca* also, while in *D. nigra* the fold above the groin usually extends to it, and is the twelfth, while that which corresponds to the first of the species before named falls just in advance of the axilla. Though this is typical of *D. nigra*, occasionally another plica appears above the groin, and the twelfth is slightly in front of it.

The pores in *D. ochrophæa* are very difficult to observe; in a few specimens I have seen a few of those of the lower series, the upper I believe to be wanting. The gular fold is distinct, and another vertical fold commences behind its extremity, and turning longitudinally extends more or less distally to the orbit. As in other species the derm adheres closely to the frontal bones and is more or less rugulose. The head is oval with rounded depressed muzzle; its greatest width enters the length to the groin  $5\frac{2}{3}$  times. The commissure of the mouth is slightly flexuose.

The appressed limbs fail to meet by four intercostal spaces. The inner digits of both feet are short, but free; longer than in *Plethodon* species of similar size, the other digits are also longer and more distinct; proportions, 1—4—2

\* The skeletons on which the present observations are based are in large part the preparations of Prof. Baird.

—3; 1—5—2—4—3; only three phalanges in longest toes. The tail is quite slender, and only compressed at the tip; in some there is a keel above on the distal third, but never any dermal fin.

The vomerine teeth are very few and small when present; they are often wanting. Their basal line is on a ridge which is convex backwards, nearly continuous medially. The parasphenoid teeth stand on two narrow plates which are well separated, especially behind, and are shortened; anteriorly they only reach to near the middle of the orbits. The mandibular teeth present peculiarities in the male, by which it may be readily distinguished from the female. In a large number of specimens the oral commissure is but little undulate, and the mandibular teeth, though longer medially, are continued to near the basis of the coronoid process. The males exhibit a strongly flexuous commissure, and the alveolar margin of the mandible is deeply concave below the front of the orbit, and edentulous. The distal portion is abruptly convex and armed with long teeth. The margin is slightly concave anterior to this point, and finally rises again at the symphysis, which is prominent and protected externally by a pad of crypts as in *D. fusca*. The structure of the males is in the mandibular dentition quite that of the genus *Analdes*, the *A. ferranus* m. presenting the characters but little more strongly. No such sexual difference can be found in the *D. fusca*, though the commissure only may be sometimes more flexuous in males. The jaws and dentition in the *D. nigra* do not differ in the two sexes. I have observed that two of the many males of *D. ochrophæa*, possess the female dentition. The tongue in *D. ochrophæa* is an elongate oval, considerably free behind.

The color of the females is a bright brownish yellow, fading to a dirty white below, with a dark brown shade on each side from the eye to the end of the tail which is darkest above, and gives the dorsal hue the character of a band. There is an irregular series of brown dots along the vertebral line. Males are rather longer and usually darker in color; thus the dorsal band is brownish, the lateral bands blackish, and the dorsal spots more distinct. In most specimens of both sexes there is a light band from the eye to the rictus oris, and the belly is always immaculate, the gular region nearly always. The testes and vas deferens are covered with black pigment; no pigment on the peritonæum of the female.

This species scarcely attains half the size of the *D. fusca*, as indicated by the numerous females with developed eggs in our collections. As the eggs are equal in size to those of *D. fusca* when ready to be discharged, and as the species is only half the size of the same, the eggs in the oviduct of a gravid female at one time are only half as numerous. I have only found from

*C. 1. D. ochrophæa* in each vessel while from 18 to 20 by the



Pennsylvania, or the lower plains of New Jersey and Maryland. Nor have I observed it in the Alleghenies of south-western Virginia; the most southern locality yet known is the Broad Top Mountain in Southern Pennsylvania, from which the Academy possesses numerous specimens from Dr. Leidy. In northern Pennsylvania and the Adirondack it is very abundant. The Academy has numerous specimens from Warren county, Penn., from Dr. Randall.

The habits of this animal are terrestrial. It occurs under the bark of every fallen log of hemlock (*Abies canadensis*), and in the debris of the dark damp forests of the north. I never saw one in the water of streams and runs, the habitat of the other species of the genus.

Prof. Baird was familiar with this species before I described it. I published his suggestions expressed in a letter, that it was the *S. haldemanni* of Holbrook. Holbrook's figure does not represent this species in any degree, nor is his description more conclusive as to the reference of this species to it rather than some others. He says it is marked with spots on the upper surfaces, which are "disposed without much regularity," but the largest are on the flanks. There are but few spots above in this animal, and they are in a regular series. The sides are banded.

No. 3917, 10 specimens, Alleghany Co., N. Y., Dr. Stevens.

No. 4041, 3 specimens, Bradford Co., Pa., C. C. Martin.

20 specimens, Meadville, Pa., Prof. Williams.

No. 4539, 5 specimens, Susquehanna Co., Pa., Prof. Cope.

*Variety* — A specimen with the dentition, coloration and proportions of body and tail of this species was sent to the Smithsonian Inst., from Georgia, by Dr. Jones. It approaches the *D. fusca* in having a small *tuberculum canthus oculi*, and a well developed inferior series of mucous pores.

**DESMOGNATHUS FUSCA**, Rafinesque.

*Triturus*, (March 1, 1820), Raf. Annals of Nature. *Sal. intermixta*, (Aug., 1823), Green, Hall's Portfolio, Vol. 20, p. 159. (Jan. 1827), Green, Cont. Mac. Lyc. No. 1, vol. 1. *Sal. picta*, (Nov. 1823), Harlan. J. A. N. S. v. 136. (1840), Storer. Mass. Rept. 251. *Sal. quadramatulata*, (1842), Hol. Herp. 2d. ed. v. 49, pl. 13.

This, perhaps the most abundant Salamander in North America, is quite variable in coloration, but not in proportions and structural peculiarities. Those of the latter which characterize it are the presence of fourteen costal plicæ on one well, and one little developed lateral series of mucous pores; the equal and regular distribution of teeth in the mandible of males; the compressed tail, keeled above, and finned distally; the presence of a tubercle in the interior canthus of the eye; the marbled color of the belly. In many quarts of specimens I find four specimens from southern localities — two in Academy from Charleston, two in Smithsonian from Biloxi, Miss., which have fifteen plicæ, but one of the latter has fourteen on one side. In specimens which have been preserved in too strong spirits the pores are rendered invisible. The same occurs when the spirit is impure or weak. In soft specimens the caudal tubercle sometimes disappears, and in many young specimens and some adult females it does not appear to exist.

The head is more depressed and the muzzle prolonged than in species of the other genera. The eyes are prominent; the plicæ behind them strongly marked. These consist of one on each side the head and nape, which converge posteriorly and then turn abruptly outwards to be continued into the gular plicæ. A second plicæ extends from the mandible across the rictus oris to the upper plicæ. A second longitudinal plicæ extends from this to the gular plicæ, forming an ovate enlarged area; and a short one to the orbit encloses a posterior subround and smaller area.

The commissure of the mouth is more undulate in males than in females. Both present a slight elongation of the symphysis produced externally by

1869.]

a pad of crypts. The width of the head enters the length 5.66 times. The vomerine teeth are often wanting, and when present, minute and few. Their basis is a ridge which extends from behind the middle of the posterior nares, across the palate with a posterior convexity. The parasphenoid patches are small and not in contact; they do not extend to opposite the middle of the orbits.

The median toes are elongate and as in *D. ochrophæa*; they fail to meet by four interspaces when pressed to the side. The tail has a characteristic form, which is invariable at all periods; near the base the section is trigonal; the dorsal keel increases in elevation, and becomes a narrow fin posteriorly; the extremity is attenuated. Its length is just equal to that of the remainder of the animal.

There are two color varieties which blend together so as to indicate that no higher value can be attached to them; one of these is the *Salamandra auriculata* of Holbrook.

Above brown with gray and pink shades; sides and belly marbled, the pale predominating; no red spots on sides..... var. *fusca*.

Above and sides black; the latter with a series of small red spots; a red spot from eye to canthus of mouth present or absent; belly marbled, the dark predominating..... var. *auriculata*.

The latter variety occurs only in the Southern States; the tubercle of the angle of the eye and the upper lateral pores are often better developed in it than in var. *fusca*, therefore approaching *D. nigra*. It is, however, easily distinguished from the latter.

Sundry specimens lack the red spots, and others have paler bellies, resembling thus the darker *fusci*. The size is the same.

In the young of *D. fusca* there is a series of pinkish incompletely separated alternating spots, in two series, covering the whole dorsal region; they are rarely so well distinguished or so bright as in the specimen of the same which furnished the type of Holbrook's *S. quadrimaculata*. The pink fades to orange brown or ochre, and to pale brown with age, and at the fullest maturity all are lost in a uniform blackish.

*Measurements. No. 6832.*

	Inches.
Length (axial) from snout to rictus oris.....	.3
" " " axilla.....	.71
" " " groin.....	1.95
" " " end vent.....	2.3

and wriggles out of sight with the greatest rapidity, and is quickly concealed by assistance of its dusky colors.

Prof. Baird originally noticed the curious disposition of the eggs in this species, which I have verified on a few occasions. As in the Anurous genus *Alytes*, the eggs on emission are connected by an albuminous thread, which soon contracts and hardens. One of the sexes protects this rosary by wrapping it several times round the body, and remaining concealed in a comparatively dry spot. How long this guard continues is not known.

The most eastern specimen I have seen is from Essex Co., Mass. Besides a great number of specimens in the Museum of the Academy, the following form the Smithsonian basis of the examination.

No. 3678,	2 specimens,	Summerville, S. Ca., ?
" 3769,	3	" Philadelphia, Pa., J. Richard.
" 3880,	8	" Anderson, S. Ca., Miss Paine.
" 3876,	2	" Summerville, N. Ca., J. McNair.
" 3883,	25	" Meadville, Pa., Prof. Williams.
" 3882,	5	" Orange, N. J., ?
" 3896,	10	" Columbus, Ohio, Leo Lesqnereaux.
" 3892,	3	" Clark Co., Va., Dr. Kennerly.
" 3893,	8	" Pittsburg, Pa., S. F. Baird.
" 3891,	7	" Mississippi, B. L. C. Wailes.
" 3904,	15	" Abbeville, S. Ca., J. B. Barratt, M.D.
" 3919,	1	" Salem, N. Ca., J. Lineback,
" 3909,	9	" " " " "
" 3914,	6	" Highland Co., Ohio, ?
" 3910,	4	" Knoxville, Tenn., Prof. J. B. Mitchell.
" 3912,	1	" Adirondack, N. Y., R. Clark.
" 3905,	1	" Columbia, Co., Pa., Dr. Henderson.
" 3925,	3	" Gloucester Va., ?
" 3708,	5	" Eutaw, Ala., ?
" 3921,	1	" Dayton, Ala., Edgeworth.
" 4718,	2	" Georgia, Dr. Jones.
" 4843,	1	" Brookville, Ind., Dr. R. Raymond.
" 5039,	1	" Georgia, Dr. Jones.
" 3901,	10	" Riceboro, Ga., Dr. Jones, <i>var. auriculata</i> .
" 4717,	2	" Georgia, " " " "
" 6530,	5	" Georgia, ? " "
" 6331,	2	" Biloxi, Miss., C. Billman, <i>var. fusc.</i>
" 6332,	4	" Georgia, Dr. Jones, " "

#### *DESMOGNATHUS NIGRA*, Green.

*Sil. n.* (Sept. 1818), Green, J. A. N. S. i. 352. *Triton n.*, (1842), Holb. *Herp. V.* 81, Ph. 27. *Desmognathus nigra*, Baird, Journ. A. N. Sci. i, p. Gray, *Catal. Brit. Mus.* 1850, p. *Plethodon niger*, pars, Hallowell, J. A. N. Sci. Phil. 1858, p. 344.

This is the most robust Salamander of the eastern regions of our Zoological domain; it is not so slender as the *Gyrinophilus porphyriticus*, but a much stronger animal. As compared with the *D. fusca*, it is much larger, the tail is more compressed and extensively finned, and the color is uniformly different. Besides the characters already pointed out in the table, it differs from *D. fusca*, as follows. The parasphenoid patches of teeth are prolonged more anteriorly, and approach very near the vomerines in most instances; they are always prolonged beyond the middle of the orbits; their prolongation is at the same time narrowed, and in most, the patches are not distinguished at this point. The vomerine series are better distinguished (though not always being oblique, separate, and not extending beyond nares. The tongue

1869.]

is, in eight specimens examined, nearly round, while it is always a long oval in the two other *Desmognathi*; finally the only male does not possess the black pigment coat of the testes, always present in the others, though as in them the vas deferens is black. The body is stouter, and the width of the head enters the length to the groin less than five times; in the others always more; this is also expressed by the existence of only twelve costal plicæ, and the fact that the appressed limbs are only separated by  $2\frac{1}{2}$  intercostal spaces.

The postorbital plicæ are not strongly marked. The mucous pores are well developed, and the two lateral series are often distinct in alcoholic specimens by their white color; when they become dry they are difficult to observe. There are two rather distinct gular series within the mandibular ramus on each side, and one on each side extending inwards and forwards from the gular plica. The superior lateral series extends from the orbit to near the end of the tail; the inferior turn round the humeri to each side the pectoral region.

The proportions of the fingers are as in *D. fusca*; they are entirely free. The eyes are prominent, with thick, opaque palpebræ. A tubercle occupies the anterior angle, which, after an examination of that in *D. fusca*, is a dismemberment of the superior eyelid.

The coloration is uniform in about twenty specimens examined. It is simple, viz., uniform black above and below, except the muzzle from between the eyes, the lower jaw, the end of the tail and the soles of the feet, which are brown.

*Measurements of 3923.*

	Inches.
Length (axial) from end muzzle to orbit.....	.29
" " " canthus oris.....	.55
" " " axilla.....	1.22
" " " groin.....	1.11
" " " end vent.....	3.76
" " " tail.....	6.96
" of fore limb.....	.69
" " foot.....	.26
" of hind limb.....	1.02
" " foot.....	.47
Width " " (sole).....	.27
" between eyes in front.....	.3
" at canthus oris.....	.65
" of body.....	.75
" " at sacrum.....	.54

## Further Notes on MICROSCOPIC CRYSTALS in some of the Gems, &amp;c.

BY ISAAC LEA.

In a paper which I recently read to the Academy, I mentioned having found acicular crystals in *Precious Garnets*. Since then I have had the opportunity of examining a number of cut specimens of *Sapphire* in the forms of *Asteria*, *Catseye*, &c. I have also examined many specimens of *Cinnamon Stone* from Ceylon, brought by Dr. Ruschenberger, of the United States Navy, also, among others, a very fine specimen of bluish *Sapphire*, in the collection of Prof. Leidy.

Having made microscopic drawings of these and other species, having included microscopic crystals, I propose to present them with as nearly correct illustrations as possible.

The whole subject of microscopic mineralogy has been of great interest to me, and I hope these short notes may induce some student to pursue the subject to a greater extent than I have had it in my power to do. It cannot fail that, with the use of the numerous admirable microscopes now made in this country, working with so much more facility than with those we have been accustomed to from abroad, observers may continue to bring to our knowledge much that has been heretofore unknown and very little suspected in this branch of science.

In my former paper I stated the proportional number among *Bohemian Garnets* which I found to contain microscopic crystals. I now propose to give descriptions and figures of the appearance of these crystalline forms, and with this view I have made drawings of their apparent forms under a power of about 100 diameters.

**Sapphire.** A very remarkably beautiful *Asteriated bluish Sapphire*, procured by Dr. Ruschenberger when in Ceylon, presented to the naked eye the six rays which in the sun were sharp and of great beauty. The specimen being set as a gem of luxury, I could not get a view by transmitted light, but by reflected light, with great care, the exceedingly minute crystals were distinctly seen. They are very short, of pearly lustre, at three different equal angles, thus producing the bands which form the rays in three directions of  $60^\circ$  each. The reflection from the sides of these minute crystals cause, of course, the asterism of six rays over any point of the curved polished surface of the specimen. These rays are formed on the same principal precisely as the asterism in *Phlogopite*, which I have mentioned elsewhere.

Fig. 1 represents the delicate, numerous, minute crystals in the beautiful *Asteria* referred to above belonging to Dr. Ruschenberger. The acicular crystals are so small that it was with great difficulty I obtained their position as here represented.

The variety of *Sapphire* (Corundum) which goes under the name of *Catseye*, has irregular coarse striae, which have the appearance of being *Asbestos* as is generally supposed. In this gem there is a single band which varies according to the position it may be placed in, and by no means has the beauty of the *Asteriated Sapphire*. Several of these are now before me which came from Ceylon.

Fig. 2 represents the crystals which I observed in a fine small bluish *Sapphire* in Prof. Leidy's fine collection of gems. The cuneiform or arrow-headed crystals are very extraordinary, and they may be simply twin crystals of some substance of which at present we can have no perfect idea. They remind us of the form of *Selenite* crystals, such as are found in the Paris Basin, and at the same time we recognise the similarity to the cuneiform character stamped on the tablets of Babylon, and cut in the alabaster monuments of Nineveh. The group which I have drawn represents six of these cuneiform crystals, and six acicular crystals. Of the former six, four had a bluish tinge and two were pinkish. The acicular crystals were disposed to take three different directions, parallel

to the prismatic hexagon sides of *Corundum*. Both sets of these crystals are enlarged to about 200 diameters, for the purpose of giving distinctly their very singular form.

Specimens of *Garnet* examined from all localities obtainable, presented very different aspects. When crystals were found in them they always proved to be acicular in form, but by no means similarly regular or of the same length, direction, or of the same size.

Fig. 2. A Bohemian cut *Garnet* presented three sets of numerous, thickly set, parallel, acicular crystals, which crossed at an angle of  $120^\circ$ , forming a very regular lattice-work appearance.

Fig. 4. A Bohemian cut *Garnet* presented only two sets of acicular crystals, which were usually at right angles, but some were inclined from perpendicularity and they were not so long as those of figure 3.

Fig. 5. A Bohemian cut *Garnet* presented a very different set of crystals. They were generally short, comparatively, and pointed in every possible direction.

Fig. 6. *Garnet* from Ceylon—*Cinnamon-stone*—fractured portions, not cut and polished. The acicular crystals were much shorter, rather thicker and much more bluntly terminated than in Fig. 5. They are placed at all angles. Ten specimens only in 80 examined had any thing like crystals, while all had irregular rifts or cavities within.

Fig. 7. *Precious Garnet* = *Pyrope?* from Green's Mill, Delaware Co., Penn., presented acicular crystals somewhat like Bohemian *Garnet*, fig. 3, but the three sets, while they take the same three directions, are shorter and left interspaces as shown in the figure.

Fig. 8. *Garnet* from North Carolina. A thin fracture from a compact garnet of large size, perhaps two inches in diameter. The acicular crystals are not very numerous—they are thin and not continuous. Connected with these are a few dark crystals. These take no particular direction like the others, but seem to be interspersed throughout.

Fig. 9. *Labradorite*. This specimen is a small polished one from Ceylon, and belongs to Dr. Ruschenberger. Besides the usual play of pavonine colors in *Labradorite*, I have found in all the specimens I have examined from various other localities, very minute reflecting crystals like those in *Sunstone*, and which are no doubt the same, but differing in size, being smaller so far as I have observed. The microscopic forms as figured will be observed to consist of two sets apparently distinct. The larger are rather irregular and black. The thinner are rather shorter and more delicate. These are not the reflection of the plates of *Calc.* they are the black crystals which are usually in dark *Labrador*.



very greatly magnified. They vary somewhat in size, and the orange-colored ones are most numerous in the specimen before me. There is a cloudiness in these yellow globules and a few are not completely spherical, presenting a cup-shaped form. To the naked eye the green globules appear to be black, but under the microscope they are evidently dark green. The composition of the two sets are no doubt the same, and the color probably depends on their being in a different state of oxidation. In a few cases I observed the two colors in the same globule. In another specimen from the same locality I found the globules to be much smaller and the green ones to prevail.\*

Fig. 13. An *Asteriated Sapphire*, also belonging to Dr. Le Conte, of an obtuse conical form, and of unusual beauty, presented very remarkable microscopic crystals of a white silken hue. The larger of two sets were generally, though not always, cuneate and lay in three directions, differing somewhat in size. In the smaller set the crystals are very minute, having the same pure white, silken appearance. These fill up the interstices of the larger crystals.

A *Sapphire* of large size and peculiar beauty, in the possession of Dr. Le Conte, presented a few distant, white silk-like lines, running in one direction, and parallel to each other. It is of unusual brilliancy and fine color and is thirteen-twentieths by eleven-twentieths of an inch in size.

Fig. 14. A *Pyrope* from New Mexico, in which the microscopic crystals differ from any of the many *Garnets* I have examined. In other specimens from this locality—of which I have examined twenty in the collections of Prof. Frazer and Dr. Le Conte—acicular crystals alone were found. In this specimen the crystals are much larger, less in number and of an entirely different character. Some are geniculate and transparent, while some are dark or semi-transparent. A very short and rather thick crystal seems to present three sides of an hexagonal prism. These New Mexican *Pyropes* are of uncommon beauty and perfection. This specimen is in the collection of Prof. Frazer. His other seven specimens have acicular crystals. Of Dr. Le Conte's twelve specimens, six had acicular crystals, and six presented no appearance of inclusions. When the acicular crystals are examined in the direct rays of the sun at right angles to their axis, they reflect all the spectral colors in a very beautiful manner.

A small brilliant *Ruby*, which has the appearance of being oriental, but which may be a *Spinel Ruby*, was found to be very full of long acicular crystals which were observed to be in all directions, and were to all appearances the same as observed in *Precious Garnets*. A larger specimen has the same kind of acicular crystals, but in this specimen these crystals take generally two directions and are oblique to each other.

Two out of four other very beautiful small *Oriental Rubies* = *Sapphire* were found to have very minute acicular crystals. In one of them these crystals were in three directions; in the other they were in two directions. Both these gave that peculiar changable band observed in the "Catseye" *Sapphires*. All these rubies were cut as brilliants and were of great beauty.

It is apparent that the microscopic crystals in the various minerals above described, cannot all be of the same substance. Their forms and appearance point that, and chemical analysis will never probably reach, with any degree of satisfaction, their ultimate constituents. Spectral analysis may, however, be able to give us some results when properly applied, which may in some measure satisfy us in regard to the composition of these interesting included microscopic crystals.

### Sexual Law in the CONIFERÆ.

BY THOMAS MEEHAN.

In some previous papers last year before this and other bodies, I was able to present, I believe, to the satisfaction of my fellow botanists, that the true leaves

\* Another set of Chester County, Penna., very frequently have minute acicular crystals.

of Conifera are mostly adherent to the branches, and that the *degree of adhesion is in exact proportion to specific or individual vigor*. I believe I can now show that the production of the sexes is influenced by the same law,—that a high stage of vitality, or vigor, is favorable to the production of female flowers; and a low stage, or comparative weakness, to the production of male ones.

Every one must have noticed that the cones of these trees are always on the strong vigorous branches towards the top of the tree, or on the ends of the strong laterals. Only this year did I observe that the male flowers are never on these strong branches, seldom near the ends of the main shoots, but down amongst the lowermost and weakest branches, and in the more interior parts of the trees.

My observations have been confined to *Pinus* and *Thuja*. I have examined many hundreds of trees; and so clearly does this law universally prevail, that I am certain I have but to point it out in order to obtain a ready assent to it.

The effects of vigor in bringing about these different sexual relations are very interesting. Taking the Scotch, Austrian and Table Mountain Pines, which I have had daily before me, the young shoot commences its axial growth early in spring. Its base is the weakest part of it, being partially formed late in the previous season, when vitality was about to take its annual rest. Therefore, according to the laws of adnation or cohesion which I have before indicated, there are no branches, but the leaves are mostly free, taking the form of long chaffy scales. As the shoot grows it gathers strength, the leaves become more and more adnate with the stem, and after a few inches of such growth the branchlets in the shape of phylloid shoots or fascicles of "pine needles" appear. These gather strength as the shoot progresses, as shown by their increasing length, until if the axis or shoot is very strong, a female cone appears. The whole process exhibits a regularly increasing vigor, during which the leaves are first suppressed, and ultimately both leaves, stem, and axis with the culmination of vigor are suppressed or metamorphosed into a female cone.

Turning again to another and weaker branch, pushing forth into spring growth, we find the base, instead of being bare of all except the free leaf scales, has little conical heads of male flowers pushing from the axils of the leaf scales, and which, if higher up, and when the shoot has attained more vigor, would be phylloid fascicles. These male heads of flowers are evidently metamorphosed branch fascicles, the first transformation of which commenced the year previous when active vitality was about to cease. It might occur here to inquire why lingering vitality would not produce in the fall rudimentary changes of the embryo fascicles at the base of the strong and ultimately cone-bearing

June 1st.

The President, DR. HAYS, in the Chair.

Twenty-one members present.

Prof. Cope exhibited some specimens of extinct reptiles of interest. One of these was the cranium, minus a portion of the muzzle of a gavial, from the New Jersey Green Sand, previously described under the name of *Thoracosaurus trerispinus*, but which this specimen demonstrated to belong to another genus, since it did not present the lachrymal foramina of the former. He applied the name *Holops* to it, and stated that he had evidence that *Crocodylus tenebrosus* Leidy, and probably *C. obscurus* L., also belonged to it.

He also exhibited drawings with measurements of portions of the limbs of a very large Dinosaur, in the collection of Dr. Samuel Lockwood, of Keyport, Monmouth County, N. J. It was discovered by this gentleman in the lower cretaceous clays on the shores of Raritan Bay. It consisted of the extremity of the tibia with astragalus and fibula. He said it indicated the second genus of his suborder Symphypoda, and was thus allied to *Compsognathus*, differing in the remaining indication of suture between astragalus and tibia, which disappeared in *Compsognathus*. The astragalus thus entirely anchylosed was also confluent with the calcaneum, forming a continuous condyloid surface for the tibia. In an anterior projection externally, the extremity of the fibula reposed by a condyloid extremity, the shaft lapping over the outline of the tibia. This demonstrated what he had already stated, that the fibulæ of *Iguanodon* and *Hadrosaurus* had been reversed. The length of the fragment was sixteen inches, the fractured section was a transverse oval, the medullary cavity nearly filled with cancellous tissue. The transverse width of the extremity 12 in.; oblique diameter 14 in. This form he called *Ornithotarsus immanis*, and placed it between *Hadrosaurus* and *Compsognathus*.

He made some observations on a fine fragment of the muzzle of a large Mosasauroid, which pertained to a cranium of near five feet in length. The pterygoid bones were separated from each other, and support nine teeth. A peculiarity of physiognomy was produced by the cylindric prolongation of the premaxillary bone beyond the teeth, and a similar flat prolongation of the extremity of the dentary. He referred the species to *Macrosaurus* Owen, under the name of *M. proriger*. The specimen he stated belonged to Prof. Agassiz, who obtained it from Western Kansas, probably from the No. 3 of the Upper Cretaceous of Hayden.

The following paper was presented for publication:

"Description of new Carboniferous Fossils from the United States." By F. B. Meek and A. H. Worthen.

Mr. Jeanes having resigned his position as Auditor, on motion, Dr. Bridges was nominated and elected to fill the vacancy.

---

June 8th.

The President, DR. HAYS, in the Chair.

Twenty-seven members present.

The following paper was presented for publication:

"On the production of Bracteæ in *Larix*." By Thos. Meehan.

---

June 15th.

PROF. FRAZER in the Chair.

Twenty-four members present.

The following paper was presented for publication:  
"Description of six new species of Fresh Water Shells." By  
Isaac Lea.

---

*June 22d.*

DR. RUSCHENBERGER, Vice-President, in the Chair.

Twenty-three members present.

The death of Dr. Charles D. Meigs was announced.

The following paper was presented for publication:

"Notice of certain obscurely known species of American Birds,  
based on specimens in the museum of the Smithsonian Institution."  
By Robt. Ridgway.

---

*June 29th.*

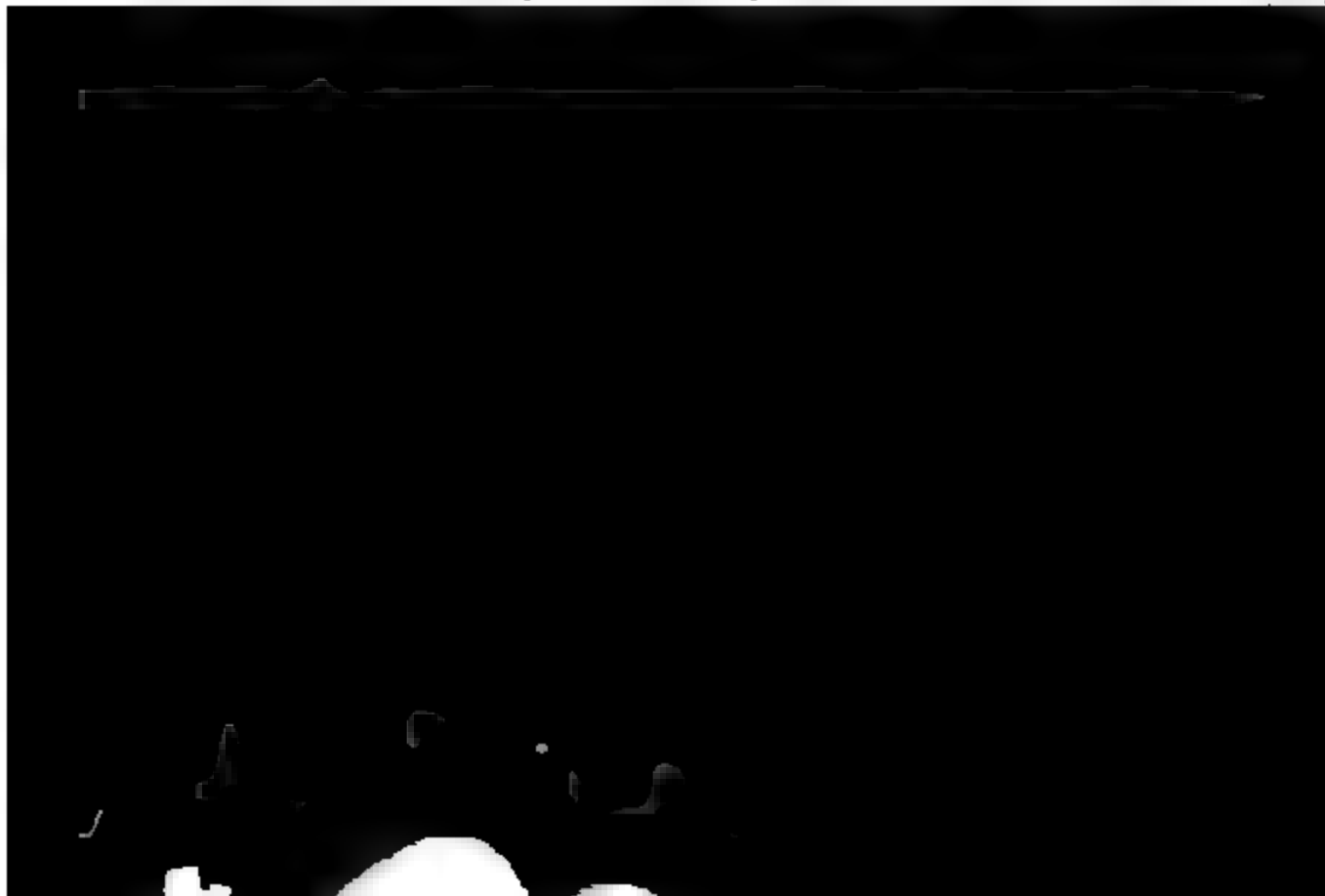
The President, DR. HAYS, in the Chair.

Twenty-five members present.

The report of the Biological and Microscopical Section was  
presented and referred to the Publication Committee.

On permission being granted, Mr. Warner spoke upon the mathematical representation of organic forms. Such limitations, he said, might serve to narrow the field of research into the physical causes of organic forms, and perhaps furnish the suggestion of a rational theory of these causes. If no other advantage were derivable from imitations of this kind, they might, he thought, be useful for description and classification.

He exhibited a representation of the longitudinal section of an egg by a curve which he called the hyper-ellipse, and of the section of an embryo by another curve which he termed a deformed lemniscate. Of the egg curve, he said that it very closely resembled an ideal section of an egg taken from a standard modern work. Of the curve representing the embryo he said that it not improbably marked the boundary of matter lying within it, in a different state of temperature, density, or tension from the matter lying without. These representations were verified by the members present. The speaker expressed the



tibus cardinalibus parviusculis, compressis crenulatisque; lateralibus sublongis lamellatisque; margarita argentea et valde iridescente.

*Hab.*—Rio Gigillillo, Corcuera, Nicaragua, Cen. Am., Mr. J. A. McNiel.

**GONIOBASIS BACULOIDES.**—Testa lævi, cylindræea, subtenui, luteola, quadrivittata; spira valde elevata; suturis irregulariter impressis; anfractibus planulatis; apertura parva, rhomboidea, intus vittata et cæruleo-alba; labro acuto, vix sinuoso; columella vix incrassata, contorta.

*Hab.*—Coosa River, Alab., Dr. Schowalter.

**GONIOBASIS LAWRENCH.**—Testa lævi, subcylindræea, subcrassa, tenebroso-cornea, dilute vittata vel evittata; spira elevata; suturis impressis; anfractibus planulatis; apertura parviuscula, rhomboidea, intus albida; labro acuto, sigmoideo; columella incrassata et cortorta.

*Hab.*—Washita River, near Hot Springs, Arkansas, Dr. Lawrence.

**SCHIZOSTOMA LEWISII.**—Testa crebrissima striata, subcylindræea, subtenui, luteo-fusca, imperforata; spira conica, plicata; suturis valde impressis; anfractibus instar septenis, ultimo grandi; fissura obliqua brevique; apertura grandi, rhomboidea, intus vittata; labro crenulato, sinuoso; columella alba, incrassata et contorta.

*Hab.*—Coosa River, Alab., Dr. Schowalter.

**PHYSA CARLTONII.**—Testa lævi, obtuse fusiformi, inflata, valde polita, tenui, subpurpurea; spira exserta, acuminata; suturis impressis; anfractibus senis, ultimo pergrandi; apertura ovata, grandi; labro expanso, intus marginato; columella impressa et contorta.

*Hab.*—Mount Diablo, California, W. G. W. Harford.

**PHYSA WOLFIANA.**—Testa subrotunda, valde inflata, polita, tenui, tenebroso-cornea; spira valde obtusa; suturis impressis; anfractibus quaternis, ultimo pergrandi; apertura ovata, grandi; labro expanso; columella medio parum impressa et parum contorta.

*Hab.*—Hot Springs, Colorado Ter., Prof. J. W. Powell.

### Notices of certain obscurely known species of American BIRDS.

(Based on specimens in the Museum of the Smithsonian Institution).

BY ROBERT RIDGWAY.

#### INTRODUCTORY REMARKS.

The following notes comprise the result of some examinations in the extensive series of North American birds in the Museum of the Smithsonian Institution, to which I was kindly allowed access by Professor Henry. They were made especially in connection with the determination of collections gathered by myself as Zoologist to the U. S. Geological Survey of the 40th Parallel, under Mr. Clarence King, principally in California, Nevada and Utah.

Crossing so wide an extent of country as that indicated, it so happened that the operations of the party allowed of extensive examination of the region along the lines of junction of the three great "Provinces" of Professor Baird's paper on the migration and distribution of North American birds, and I had frequent occasion to confirm, and in some cases to extend his remarks relative to the affinities of the species of the different regions, and especially to their hybridization, and to learn to what extent this may take place, and therein tend to perplex the naturalist in his endeavors to determine the exact character of his collections. When to this is added the change which confessedly the same species undergoes under different climates, elevation, and geographical distribution, it is no wonder that many cases exist in which even our best critics may reasonably confess themselves at fault as to the precise name of the specimen, especially in view of the fact that Mr

1869.]

are hastily prepared by persons of little skill in such matters, and are more or less deteriorated by packing and transportation.

The first question upon which we propose to treat is the line to be drawn distinguishing "species" from "varieties." I do not, however, intend to discuss at any length this difficult and perplexing point, but only as it touches more directly upon the birds to be noticed, and in the case of several of them it may possibly well be left (as the matter now stands) entirely to one's discrimination, whether he is to regard them as valid "species" or subordinate "varieties."

Now we must and do admit a certain extent of variation, influenced by different agencies, as age, season, and locality, when the cause of such variations can be thus satisfactorily explained. It does not follow, however, that, because we have a series connecting by a gradual transition two extremes, we are to consider the whole as one species, the discrepancies indicating different varieties. The difference between these extreme examples is often too great to admit of this; and when we have traced a species through all its variations to a certain point where the discrepancy from the typical style is too great and uniform to be accounted for by any physical cause, it becomes us as naturalists to assign to such extreme conditions a specific rank. What more can we do? and what is more in accordance with the laws of nature? Therefore we cannot do better than to accept as valid these representative forms, when they can be assigned distinctive habitats; and where they are substantiated by a sufficiency of specimens, to such we may allow a reasonable extent of variation, not, however, beyond the limit controlled by physical causes.

We find that in all cases where individuals occur which apparently connect the approaching extremes of two well defined representative forms, that such are almost always from localities inhabited by each, or from the region where their respective habitats overlap. It is under such circumstances that we must admit *hybridization* among birds, and abundant evidence can be adduced that such hybridization does occur between congeneric species, and that it is not only occasional but general; indeed an instance will hardly be found where, by collecting in the region where an eastern species and its western representative are found together, the collector will not obtain hybrid specimens. Such has been the case with myself respecting several species, as well as with nearly all others who have made ornithological collections in the West.

What more conclusive evidence of hybridization need we have than an examination of the numerous examples of such a condition of *Colaptes* from the upper Missouri region, where the ranges of eastern *C. auratus* and western *C.*

*sella magna* and *S. neglecta* — *Cyanura stelleri* and *C. macrolopha* — *Cyanocitta californica* and *C. woodhousii* — *Anser gambelii* and *Bernicla hutchinsii*, and many others which I need not here mention—all, I may again say, from the regions where the habitats of the two representative species overlap.

Premising these general considerations I proceed to discuss in detail some closely allied species to which my attention has been specially called in the course of the investigations referred to.

### 1. *The North American Wood Thrushes.*

#### Genus HYLOCICHLA, Baird.

Some authors seem inclined to doubt the validity of several species of this group, as characterized by Professor Baird. These are the *H. aliciae*, Baird, *H. ustulatus*, Nutt., *H. nanus*, Audubon, and *H. audubonii*, Baird, these being referred to *swainsonii*, Cabanis, *fuscescens*, Stephens, and *pallasi*, Cabanis. A careful examination of the very extensive series of these birds in the Smithsonian collection has, however, convinced me that they are all (with perhaps the exception of *audubonii*) justly to be regarded as distinct species.

I do not propose to speak here at any length in regard to the characters of these species, as they have been well presented by Professor Baird, in his work on the "Birds of North America," and in his later "Review of American Birds," but intend merely to give a few additional features which the species constantly present in distinction from one another. The more important synonyms only are given.

The species I arrange according to the following synopsis:

- A. Upper surface much brightest anteriorly, the rufous of the crown being decidedly more intense than the olive of the posterior portions; white beneath continuous; spots large, sharply defined, pure black, and extending far back.

This style is represented by a single species, the well known *T. musletinus*, Gm., which needs no comparison with any other.

- B. Olive of back uniform from head to tail, but varying in shade.

*T. fuscescens*, *T. ustulatus*, *T. swainsoni* and *T. aliciae* are of this pattern.

- C. Olive of the back passing very sensibly, or even abruptly, into reddish on upper tail coverts and tail.

The species representing this style are the *T. pallasi*, *T. audubonii* and *T. nanus*.

#### TURDUS FUSCESCENS.

*Turdus fuscescens*, Stephens, Shaw's Gen. Zool. Birds, X, i, 1817, 182—Baird, Birds N. Am. 1858, 214.—*Turdus (Hylocichla) fuscescens*, Baird, Rev. Am. Birds, I, 1864, 17.

*Sp. ch.* Above tawny rufescent olive, uniform on all parts, but occasionally with a tendency to a greater intensity on dorsal region. Pectoral aspect peculiar: throat with a series of faint brown dashes on each side, these continuing down sides of neck and extending very sparsely across the breast, where they become more sharply defined; the region of these markings with a fine cream colored tinge, quite different from the buff of *ustulatus* and *swainsoni*. Like the *T. aliciae*, this species lacks entirely the yellowish or lighter orbital ring.

#### TURDUS USTULATUS.

*Turdus ustulatus*, Nuttall, Man. I, 1840, 400—Baird, Birds N. Am. 1858, 275, pl. lxxvi, fig. 1.—*Turdus (Hylocichla) ustulatus*, Baird, Rev. Am. Birds, I, 1864, 18.

*Sp. ch.* General appearance of *fuscescens*, but with pattern of *swainsoni*, the buff orbital ring as conspicuous as in latter. The olive above is more brown than in this, and less yellowish than in *fuscescens*, becoming decidedly more  
1869.]

rufescent on wings and less observably so on tail. Pectoral aspect different from *fuscescens*, the spots narrow and cuneate, sharply defined, and arranged in longitudinal series; in color they are a little darker than the crown.

This well marked and perfectly distinct species is to be compared with *swainsonii*, not with *fuscescens*, as has generally been done; the latter, except in shade of colors, it scarcely resembles at all; still greater evidence that such is its affinity is that the *T. ustulatus* builds its nest on a tree, and lays a spotted egg, like *swainsonii*, while *fuscescens* nests on or near the ground, perhaps never in a tree, and lays a plain blue egg.

#### TURDUS SWAINSONII.

*Turdus swainsonii*, Cabanis, Tachidi, Fauna Peruana, 1844, 46, 188—Baird, Birds N. Am. 1858, 216.—*Turdus (Hylocichla) swainsonii*, Baird, Rev. Am. Birds, I, 1864, 19.

*Sp. ch.* Olive above dark and pure, of a continuous shade throughout; in extreme western examples, with a clear dark greenish tint. A very broad, conspicuous ring of buff around the eye, running forward over the lore, and a very decided tinge of the same on breast. Pectoral spots well defined, deltoid, becoming more transverse posteriorly, dull black.

Specimens examined from the northern regions (Gt. Slave Lake, Mackenzie's River and Yukon) to Guatemala; from Atlantic States to East Humboldt Mts., Nevada, California, and from intervening localities. The extremes of variation are the brownish olive of eastern and clear dark greenish olive of remote western specimens. There is no observable difference between a Guatemalan skin and one from Ft. Bridger, Utah.

#### TURDUS ALICIAE.

*Turdus aliciae*, Baird, Birds N. Am. 1858, 217, pl. 81, fig. 2—Cones, Pr. Ac. Nat. Sciences, Phil. Aug. 1861, 217.—*Turdus (Hylocichla) aliciae*, Baird, Rev. Am. Birds, I, 1864, 21.

*Sp. ch.* The olive above, similar to that of *swainsonii*, is scarcely more greenish, but is generally decidedly darker, and often with the slightest possible tinge of rich sepia or snuff brown, this becoming gradually more appreciable toward the tail; in these typical examples this tint is quite peculiar; when the shade approaches that of *swainsonii* it is generally when there are other unmistakable evidences of hybridism. There is in this species not a trace of a lighter loreal stripe and orbital ring, so characteristic of *swainsonii*, this whole region being grayish, scarcely different from the cheek; with the exception of the lack of decided buffy tinge, the pectoral aspect is that of *swainsonii*.

A specimen from Costa Rica is undistinguishable from typical examples from the eastern U. S.

**TURDUS NANUS.**

*Turdus nanus*, Audubon, Orn. Biog. V, 1839, 201—Baird, Birds N. Am. 1858, 213.—*Turdus (Hylodichla) nanus*, Baird, Rev. Am. Birds, I, 1864, 15.

*Sp. ch.* Above with the clear dark olive of *swainsonii*, but this even purer and more plumbeous. Upper tail coverts (but not lower part of rump) becoming more rufous, the tail abruptly darker, richer and more *purplish* rufous, approaching to chestnut. The clear olive of the neck passes into brownish *plumbeous* along sides; pectoral spots more sparse and less pure black than in *pallasi*. The white beneath is of an almost snowy purity, appreciably different from the cottony white of *pallasi*. A very tangible and constant character possessed by this perfectly distinct species is the more slender and depressed bill, as compared with that of *pallasi*. Specimens vary only in intensity of colors: these variations very limited, and corresponding with those of *pallasi*. In all cases, however, their precise pattern and peculiar distribution is retained.

**TURDUS AUDUBONII.**

*Turdus (Hylodichla) audubonii*, Baird, Rev. Am. Birds, I, 1864, 16.

*Sp. ch.*—Relative proportions of *nanus*, but much larger even than *pallasi*, the bill much more elongate and slender. Plumage similar to that of *pallasi* but lighter and more grayish; the rufous posteriorly more restricted and more yellowish even than in *pallasi*; pectoral spots larger and more sparse than in *pallasi*, clove brown instead of nearly black, breast and neck almost entirely destitute of any yellowish tinge. This species, the validity of which may by some be questioned, differs principally from *pallasi* in being much larger and more slender, with the arrangement of colors as in *nanus*, although the shades are more as in *pallasi*.

In regard to the above mentioned thrushes, the discussion as to whether they be all descended from as many primitive creations, whether there be three species with several varieties each, or finally whether all be merely modifications of one original type, would involve the opening of the whole question of the origin of species, and what constitutes genera and species and need not be presented here. Whether one naturalist calls them species, and another races or varieties, so much is, I consider, well established—that there are seven forms of N. American thrushes requiring names, all of definable characters, and all having a well marked region of distribution. Also, that these forms are permanent over a large area, but that as in many other instances where the areas of two overlap, we have suddenly intermediate or hybrid birds that are with difficulty to be referred to either; and that these intermediate birds mixing with the others in their migrations tend to obscure the series: but that, as a general rule, specimens taken in the breeding season are distributed geographically and colored, as stated above.

2. On the uniformly red species of *Pyrrhula*, with descriptions of a new N. American species or variety.

In treating of the species of this form of the genus *Pyrrhula*, I have endeavored to be as conservative as possible in my conclusions, and have, after careful consideration of the species, represented in all their various conditions by the immense series of specimens before me, made due allowance for the variations which may accrue from natural causes, as difference of habitat, &c., and in designating the species, have allowed to each the widest possible limit, treating all varieties as subordinate.

Of the present group we find two styles, one with the *Pyrrhula aestiva*, Vieillot, as type, characterized by large light colored bill, without conspicuous tooth on mandible, and with no marked contrast between tints of upper and lower surfaces. This group contains, besides the *P. aestiva*, the *P. sara*, Selater, and *P. cooperi*. The other, with the *Pyrrhula hepatica*, Swainson, as type, is distinguished by plumbeous-black bill with prominent commissural tooth, and the

upper surface of body being quite different in tint from the lower. The species, besides the type, which belong to this group, are the *P. testacea*, Sclater, and Salvin, and *P. azarae*.

Of all the species the *astiva* has the widest range of habitat, this including the "Eastern Province" of the United States, Eastern Mexico, Central America, and the northern part of South America. In Western Mexico, and the southern "Middle Province" of the United States, the *astiva* is replaced by the closely allied *P. cooperi*. The *P. hepatica* belongs to the mountain regions of Mexico, extending along the elevated lands into the southern Rocky Mountains of the United States; allied to this are the *P. testacea* of Central America, and *P. azarae* of south-eastern South America. The South American representative of the *P. astiva*, is the *P. saira*, of Brazil.

*PYRANGA ASTIVA*, Vieillot.

*Tanagra astiva*, Gmelin, Syst. Nat. I, 1788, 889.—*Pyranga astiva*, Baird, B. N. A. 1838, 301.—Aud., Birds Amer. II, pl. 209.



13120

*Sp. Ch.*—Length 7.25, extent 12.00, wing 3.81, tail 2.96, culmen .70, tarsus .60. Bill dilute, horn color, darker towards culmen, paler along commissure. Prevailing tint pure vermilion, the whole upper surface more dusky purplish red, uniform from bill

to tail, perhaps a little more reddish on upper tail-coverts and lower part of rump. Exposed tips of primaries, and inner webs of upper secondaries pure umber-brown.

Female—Yellowish olivaceous, purer dull yellow beneath; above more olive greenish.

This species is one of wide distribution, its habitat in the United States, including the "Eastern Province," is north to Nova Scotia, and west toward the Rocky Mountains, along the streams watering the plains, through Texas, into Eastern Mexico, Central America, the northern part of South America, as well as some of the West India islands.

In the different regions of its habitat the species undergoes considerable variations as regards shades of color, and proportions. Specimens from Texas and Eastern Mexico exhibit a decided tendency to longer bills and more slender forms than those of the eastern United States; the tails longer and colors rather purer. In Central America and New Grenada the species acquires the greatest perfection in the intensity and purity of the red tints, all specimens being in this respect noticeably different from those of any other region.\*

Specimens from Peru (35849 ♂ 35850 ♀ red winged ♀, land-waters Hamilton)

lighter dusky red than in *æstiva*; exposed tips of primaries pure slaty umber, primaries faintly margined terminally with paler, (in the type, this character is not apparent, owing to the feathers being somewhat worn; in other specimens, however, it is quite a noticeable feature, although possibly not to be entirely relied on.

*Female*.—Above orange olivaceous, beneath more yellowish, purest medially; crissum richer yellow than other lower parts, being in many individuals intense indian-yellow, with the inner webs of the tail feathers margined with the same; quite distinct line of orange yellow over the lores.

*Habitat*.—Southern "Middle Province" of U. S., south of 35th parallel, and between 104th and 106th meridians. Pacific slope of Mexico.

This species, or at least very well marked race, which I dedicate to Dr. J. G. Cooper, so well known for his researches in the Natural History of Western North America, appears to be well established, and quite distinct from *æstiva*, to which it is most nearly related. From this it may readily be distinguished, however, by larger size, (length 8.60, instead of 7.25; wing 4.24 instead of 3.81, etc.), the bill especially being much larger, (.84 instead of .70), as well as more swollen; the wing is more pointed, the primaries extending 1.16 beyond the secondaries, instead of about .84, as in *æstiva*. The third quill is generally longest, but in some specimens the second and third are equal; in *æstiva* the second is usually longest.

The most perfect representatives of this species are three specimens obtained within the limits of the United States; these are a pair (Nos. 34344♂, and 34345♀, Los Pinos, New Mexico), collected by Dr. Coues, and an immature male, collected by Dr. Cooper, at Ft. Mohave, on the Colorado River. These specimens have, owing to their peculiar habitat, a faded, or worn plumage, somewhat different from the perfect stage represented in specimens from Western Mexico, but differing from the typical style only in a bleached or faded appearance, more or less characteristic of all birds of the southern portion of the Great Basin.

#### PYRANGA SAIRA, Spix.

*Tanager saira*, Spix, Av. Bras. II, pl. 48, f. 1.—*Pyranga saira*, Sclater, Catal. Am. Birds, 80.—*Pyranga mississippiensis*, Lafr., and D'Orb.—*P. coccinea*, Barmeister.

*Sp. ch.* Wing 4.12, tail 3.52, culmen .81, tarsus .72; 2d and 3d quills longest. 1st intermediate between 3d and 4th. Bill shaped much as in *Cooperi*; the upper aspect is almost precisely the same in the present bird, being, however, rather broader at the base; the lateral aspect is, however, quite different in the two; the present species having the culmen less regularly arched, the terminal curve being more abrupt, the lower mandible is decidedly inferior in depth to the upper. There is quite a decided indication of a tooth about the middle of the commissure. In this species the color of the bill is much darker than in either of the other species of the group, in this respect approaching more nearly the *hepatica* style: the upper mandible being dark sepia, the lower much paler and more bluish.



Above rich dark purplish red, almost exactly as in *æstiva*, but becoming bright scarlet on the forehead, this continuing back over the eye in a quite conspicuous superciliary stripe. Lower parts rich fine scarlet, very pure and clear, somewhat tinged with brownish laterally.

*Female*.—The graduation of the tints exactly as in the male, the scarlet of which is replaced by gamboge yellow, the dusky red by golden greenish olivaceous. The superciliary stripe is in both sexes a conspicuous feature.

1869.]

*Hab.*—Brazil. (Type 50994♂, and 50995♀. Brazil, Sr. Don Fred. Albuquerque.

This species, although belonging to the *estiva* style, is nevertheless a well marked one, and one for the identification of which a comparison with the others is scarcely necessary. In uniformity of colors, as well as in general style of color, it much resembles *estiva*; the superciliary stripe, however, at once distinguishes it from this. The red of this species is also very different from that of any other, being purer and richer, approaching in fineness and tint that of *Pyranga rubra*.

*PYRANGA HEPATICA*, Swainson.

*Pyranga hepatica*, Swainson, Phil. Mag. I, 1827, 438—Baird, B. N. A. 1858, 302.—*Pyranga dentata*, Licht.—*P. azarae*, Woodhouse, Sitgreave's Report.

*Sp. ch.* "Length 8.00," wing 4.12, tail 3.36, culmen .68, tarsus .84. Second quill longest, first intermediate between fourth and fifth. Bill somewhat



shorter than that of *estiva*, but broader and higher at the base, becoming compressed toward the end; a distinct prominent tooth on commissure. Color plumbeous-black, paler, or more bluish plumbeous on lower mandible. Head above brownish red, purer anteriorly; rest of up-

per parts and sides brownish ashy, tinged with reddish; edges of primaries, upper tail-coverts and tail, more reddish. Beneath, medially, fine light scarlet, most intense on the throat, growing gradually paler posteriorly. Lores and orbital region grayish white; eyelids pale-red; ear-coverts ashy red.

*Female.*—Above ashy greenish olivaceous, brightest on forehead; edges of wing feathers, upper tail-coverts and tail, more ashy on the back; beneath nearly uniform olivaceous yellow, purer medially; lores ashy; a superciliary stripe of olivaceous yellow. Young male similar to the female, but forehead and crown olivaceous-orange, brightest anteriorly; superciliary stripe bright orange, whole throat, abdomen and breast medially rich yellow, most intense and tinged with orange-chrome on throat.

*Hab.*—Mountain regions of Mexico and Southern Rocky Mountains of U.S.

This species differs from all the others in the great restriction of the red; this being confined to the head above, and median lower surface, the lateral and upper parts being quite different reddish-ashy. The shade of red is also peculiar, this being very fine and light, of a red-lead cast, and most intense anteriorly.

out teeth; less ashy color above, and less restriction of the red below, the whiter lores and more reddish cheeks.

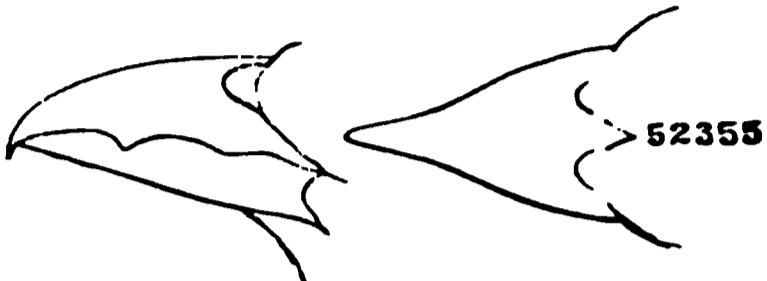
*Hab.*—Paraguay. Type 20996, ♂. Expl. Parana, Capt. T. J. Page, U. S. N.

I do not feel entirely sure that this bird is the species of D'Orbigny, nor that it may not be undescribed. I present it, however, under the above name for further consideration.

**PYRANGA TESTACEA**, Sclater and Salvin.

*Pyranga testacea*, Sclater and Salvin, Pr. Z. S. 1868, 388, Veragua.

*Sp. ch.* Wing 3.48, tail 3.12, culmen .76, tarsus .80. Bill very large and much swollen; very broad at base, becoming quickly compressed toward tip; tooth on commissure very prominent and conspicuous. Upper mandible nearly pure black, lower more plumbeous. Color generally very dark testaceous red, becoming gradually purer brownish scarlet medially beneath; lores, suborbital space and extreme border of chin grayish.



*Female.*—Olivaceous green above, and deep olivaceous orange anteriorly beneath, the gradation of the tints exactly as in the male.

*Hab.*—Veragua, Costa Rica (Angostura), Rio Manati and Belize.

Described from a type specimen presented to the Smithsonian Institution by Mr. Salvin.

### 3. *The Smaller Quiscali of the United States.*

In making an examination of a very large series of the smaller Grakles of the United States, I was struck by a radical difference in form and color between specimens from the Atlantic and interior States, which I find to be sufficiently constant to warrant the separation into two distinct varieties if not species.

Professor Baird refers to this difference in his work on the Birds of N. Am. (see p. 556), and mentions its constancy, which I have been able to confirm.

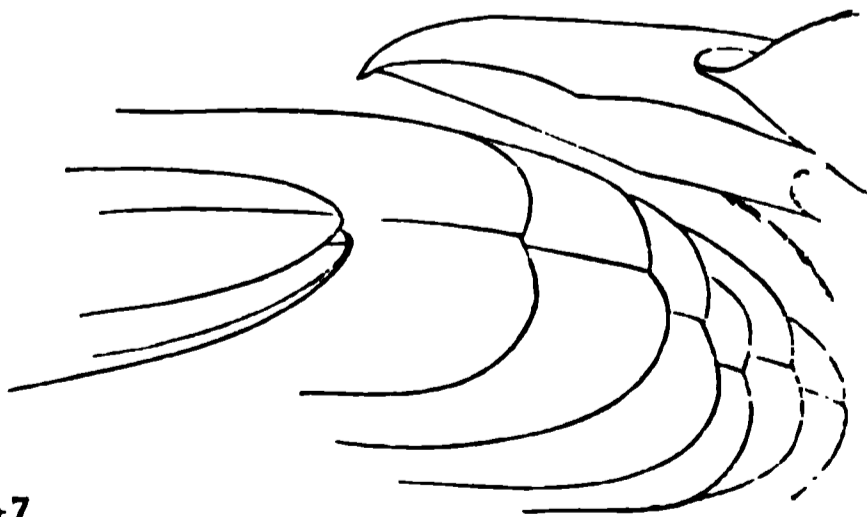
The following diagnoses are intended to express the distinctions referred to:

**QUISCALUS PURPUREUS**, Bartram.

*Gracula quiscal*, Linn., Syst. Nat. ed. 10. I, 1758, 109 (*Monedula purpurea*, Cat.)—Wils. Am. Orn. III, 1811, 44, pl. 21, f. 4. *Gracula purpurea*, Bartram, Travels Florida, 1791, 290. *Quiscalus purpureus*, Cassin, Pr. A. N. S. 1866, 403. *Quiscalus versicolor*, Vieillot, Nouv. Dict. 28, 1819, 488—Baird, B. N. A. 555.

Fig. 1.

*Sp. ch.* Length about 12.50, wing 5.50, tail 4.92, culmen 1.24, tarsus 1.28. Second quill longest, hardly perceptibly (only .07 of an inch) longer than the first and third, which are equal; projection of primaries beyond secondaries 1.56; graduation of tail .92. General appearance glossy black; whole plumage, however, brightly glossed with reddish violet, bronzed purple, steel blue and green; the head and neck with purple prevailing, this being in some individuals more blueish, in others more reddish; where most blue this is



1869.]

purest *anteriorly*, becoming more violet on the neck. On other portions of the body the blue and violet forming an iridescent zone on each feather, the blue first, the violet terminal; sometimes the head is similarly marked. On the abdomen the blue generally predominating, on the rump the violet; wings and tail black, with violet reflection, more blueish on the latter; the wing coverts frequently tipped with steel blue or violet. Bill, tarsi and toes pure black; iris sulphur yellow.

*Hab.* Atlantic and Gulf? States, north to Nova Scotia, west to the Alleghanies.

This species is more liable to variation than any other; the arrangement of the metallic tints varies with the individual; there is never, however, an approach to the sharp definition and symmetrical pattern of coloration characteristic of the western species. One specimen (No. 31049, Washington, D. C.) is wonderfully similar, in the darkness and distribution of tints, to the *Q. aglaeus*, Bd., but resembles this in these respects only.

Wilson's figure conveys a good idea of this species; Audubon represents the western style, although his description is of the eastern.

The exact name of this species is a matter of some question. It is undoubtedly the *Gracula quiscal* of Linnaeus, as based on the purple jackdaw of Catesby, which, although generally considered as the same with the common crow blackbird of the northern States, is more like *major*. The *Gracula purpurea* of Bartram from Florida, again, though excluding *major*, may include *aglaeus*. *Q. versicolor*, of Vieillot, embraces various West Indian species, though essentially belonging to the crow blackbird. On the whole, for the present, at least, I will follow Mr. Cassin in retaining Bartram's name of *purpurea*.

*QUISCALUS AENEUS*, Ridgway.

*Quiscalus versicolor*, Aud., Orn. Biog. pl. vii; Birds Amer. iv, pl. 221, (figure but not description).

Fig. 2.

*Sp. ch.* Length 12.50 to 13.50, wing 6.00, tail 6.00, culmen 1.26, tarsus



1.32. Third and fourth quills longest and equal; first shorter than fifth; projection of primaries beyond secondaries 1.28; graduation of tail 1.48.

Metallic tints rich, deep and uniform. Head and neck and round eye.

successive bands on the feathers over the whole body, producing a peculiar iridescent effect. In the *Q. mex.* nothing of this character is seen; for, among a large series of western specimens, not one has the body other than continuous bronze, the head and neck alone being green or blue, and this sharply and abruptly defined against the very different tint of the other portions. These colors of course have their extremes of variation, but the change is only in the shade of the metallic tints, the precise pattern being strictly retained. In the present species the colors are more vivid and silky than in the eastern, and the bird is in fact a much handsomer one.

*QUISCALUS AGLAUS*, Baird.

*Quiscalus baritus*, Baird, B. N. A. 1838, 556, pl. 33, not of Lesson.—*Quiscalus aglaus*, Baird, Am. Jour. 1866, 84—Cassin, Pr. A. N. S. 1866, 404.

Fig. 3.

*Sp. ch*—Length 11.00, wing 5.30, tail 5.12, culmen 1.24, tarsus 1.28. Second and third quills equal and longest; first shorter than fourth; projection of primaries beyond secondaries 1.12; graduation of tail 1.00.

Bill very slender and elongated, the tip of upper mandible abruptly decurved: commissure very regular.

Metallic tints very dark. Head and neck all round well defined violaceous steel blue, the head most blueish; body soft dull bronzy greenish black, scarcely lustrous; wings, upper tail coverts and tail blackish steel blue, the wing coverts tipped with vivid violet bronze; belly and crissum glossed with blue.

*Hab.*—South Florida.

This species is quite well marked, differing from the two preceding in much smaller size, with more slender and more decurved bill.

The arrangement of the colors is much as in the larger western species, while the tints are most like those of the eastern. All the colors are, however, darker, but at the same time softer than in either of the others.

In form this species approaches nearest the western, agreeing with it in the primaries, slender bill, and more graduated tail, and indeed, its relations, in every respect, appear to be with this rather than the eastern.



10341

July 6th.

The President, DR. HAYS, in the Chair.

Ten members present.

July 13th.

DR. BRIDGES in the Chair.

Twelve members present.

869.]

Mr. Meehan presented leaves of the Peach and Cherry, and said it had fallen to him to point out that the leaf blades of plants were developed in proportion as vigorous vitality was relaxed, and that they were adherent or decurrent in proportion as vigor or vitality was thoroughly developed in the central axis or stem. By following out the same line of observation he had discovered the law which governed the production of sexes in plants, and he now wished to call attention to the operation of the same cause in the production of glands on the leaf stalks of the Peach and Cherry.

A careful examination of a gland-bearing variety of either of these would show that these glands were simply germs of the cellular matter which formed the leaf blade. They may be seen in every stage of development from dense full globes on the petioles to very small dots on the apex of the tolerably well expanded matter, and it will be further seen that in proportion as vitality is weak are these germs and glands developed. Leaves from the shaded center of the tree, or from shoots weak or enfeebled from any other cause, produce glandless leaves, while the stronger the shoot, the stronger and more numerous are the glands or undeveloped parts. Remembering that these glands are but undeveloped leaf blades, and that I have proved in former pages that plants develop these less freely in proportion to a vigorous axial or stem growth, it should necessarily follow that a weakened vitality would be indicated by an absence of glands. That this is so in the cases before us, these weak and glandless leaves show. But I have had a very remarkable confirmation of this by the observations of Peach growers who have had no knowledge of these recent physiological discoveries. Many varieties of Peaches have no glands, and these have been found by the growers of southern Illinois, as I am informed by Dr. Hull, of Alton, in all cases to be the first to succumb to diseases or unfavorable circumstances. It is very seldom that the developments of science, and untutored observation, go along together and so thoroughly accord. To me it is one of the most interesting facts I have met with in support of my theory—that the degree of separation of the leaf-blade from the main stems is wholly a question of vitality.

Mr. Meehan exhibited some fibre obtained from Mr. Ræzel, of Vera Cruz, which was fewer and stronger than that furnished by the "Ramie." Mr. Ræzel obtained it from a plant which he had found in the Alleghanias, and which he believed to be a new species of *Bahmeria*. Mr. M. had, however, since found it abundantly along the Missouri River, and it proves to be only *Urtica purpurascens*, Nuttall.

---

## Descriptions of New Carboniferous FOSSILS from the Western States.

BY F. B. MEEK AND A. H. WORTHEN,  
Of the Illinois State Geological Survey.

## ECHINODERMATA.

## Genus POTERIOCRINITES, Miller.

The typical forms of this genus have a more or less obconical body, with a protuberant base, strong rounded column, and generally long, stout, bifurcating arms, always composed each of a single series of pieces. The body is composed of five basal pieces, alternating with five subradials, and five first radials, all alternating with the latter, excepting one on the anal side, which rests directly upon the upper truncated edge of one of the subradials.

The anal series consists, normally, of two alternating vertical ranges of pieces, the lowest piece of which rests between the upper sloping sides of two of the subradials, partly under one side of the first radial on the right, and connects above its middle, on the left, with another resting on the upper truncated edge of one of the subradials, and joining the first radial on the left, while usually one or two more above these connect with others belonging more properly to the base of the so-called proboscis. The primary radials above the first are free, and generally smaller, and vary in number in the different rays of the same individual, from about two to eight, ten, twelve or more, below the first bifurcation. The ventral part of the body is produced upward in the form of a cylindrical, or more or less expanded proboscis (so called), generally as wide as the whole space between the arms below, and composed of regular hexagonal pieces, often with pores passing through the sutures between. The opening is said to be near the top of the proboscis, though we have never seen it in any of the numerous specimens we have examined.

In addition to the species agreeing in all respects with the characters above given, there are numerous others which, although conforming in general structure with the typical forms, still depart so widely in some of their characters, that when the extremes are compared, it seems difficult to believe that they can all belong to one genus. And yet they are all linked together by so many intermediate gradations that, in the present state of our knowledge of these fossils, we are at a loss to see how they can be separated more than subgenerically. For some of these types the names *Scaphiocrinus*, *Zacrinus*, *Cæliocrinus*, etc., have been proposed, either as subgenera or as distinct genera from *Poteriocrinites*. Adopting the former view, these groups may, in order to facilitate their study, be arranged as follows, commencing with *Poteriocrinites* proper:

## 1.—Genus POTERIOCRINITES, Miller.

Represented by such forms as *P. crassus*, Miller, *P. conicus*, Phillips, *P. Missouriensis*, Shumard, and *P. Swallowi*, M. and W.

## 2.—Subgenus SCAPHIOCRINUS, Hall; or GRAPHIOCRINUS, de Koninck and Le Hon.\*

The characters distinguishing this group, as it is generally understood, from *Poteriocrinites* proper, may be stated as follows: Species generally of smaller size and less robust habit, with only two (or rarely three) primary radial pieces

---

\* It seems highly probable, as has been suggested by Mr. Lyon and Dr. Shumard, that the type on which de Koninck and Le Hon founded their name *Graphiocrinus*, may have five minute basal pieces hidden by the column in the concavity of the under side, within the range apparently belonging to the basal series, as is the case with many American forms. If so, the typical form of *Scaphiocrinus* would present no difference of even subgeneric importance, and the name *Scaphiocrinus* would have to be abandoned; in which case the American species would have to be called *Graphiocrinus simplex*, *G. spinobrachiatus*, *G. tortuosus*, &c.

to each ray, excepting sometimes in the anterior ray. Second radial pieces generally contracted in the middle, and usually separated from the first radials by gaping sutures. Arms generally shorter and sometimes simple, often with the pieces so arranged as to present a zigzag appearance. Body short and rounded or concave below, or varying to an inverse bell shape or obconic outline.\* Anal pieces sometimes with only a single one included as a part of the wall of the body.

Includes *S. simplex* (the type), *S. spinobrachiatus*, *S. tortuosus*, *S. doris*, *S. æqualis*, *S. carinatus*, *S. dichotomus*, *S. dactyliformis*, *S. divaricatus*, *S. Halli*, *S. nodobrachiatus*, *S. lyriope*, *S. orbicularis*, *S. ramosus*, *S. robustus*, *S. subcarinatus*, *S. subtortuosus*, *S. uncus*, and *S. Whitei*, Hall, as well as his *Cyathocrinus macropleurus*. Also *S. longidactylus*, McChesney and *S. decadactylus*, *S. macrodactylus*, *S. solidus*, *S. Wachsmuthi*, *S. Cho*, *S. Thetys*, *S. nanus*, *S. delicatus*, *S. penicillus*, *S. fucellus*, *S. scalaris*, *S. juvenis*, *S. rudis*, *S. liliiformis*,† and *S. notabilis*, M. and W.

*Poteriocrinites dactyloides*, *P. latifrons*, of Austin, and *P. tenuis*, of Miller, would also fall into this section, giving it the limits usually admitted.

### 3.—Subgenus ZEACRINUS, Troost.

Differs from *Scaphiocrinus* in having the body more generally rounded and concave below, and always with more than one anal piece included as a part of the walls of the body. Also in having the arms generally more frequently bifurcating and the inner divisions all simple, as well as in having the free radials generally wider.

Includes *Z. magnoliaformis*, Troost; *Z. elegans*, *Z. ramosus*, *Z. paternus*, *Z. intermedius*, *Z. scoparius*, and *Z. Wortheni*, Hall; *Z. bifurcatus*, McChesney; *Z. ovalis*, Lyon and Cassidy; *Z. spinosus*, Owen and Shumard; and *Z. discus*, *Z. Troostoni*, *Z. scrobina*, *Z. asper*, and *Z. lyra*, M. and W. Also *Z. perungulatus* and *Z. succulus*, White.

### 4.—Subgenus COLIOCRINUS, White.

Differs from *Scaphiocrinus* in having the ventral prolongation much inflated or balloon shaped, instead of nearly cylindrical.

Includes *Poteriocrinus dilatatus*, and *P. ventricosus*, Hall.

### POTERIOCRINITES? PERPLEXUS, M. and W.

Body small, somewhat cup shaped, with sides a little expanding above and rounding to the column below; height to top of first radial pieces more than half the breadth at the same point. Base small, much depressed, or nearly flat, with a pentagonal outline. Subradial pieces each nearly as large as the whole base about as wide as long three hexagonal and two heptagonal

ceeding radials. Anal pieces presenting the usual arrangement of a double alternating series, the lowest being partly under one side of the first radial on the right, while the next on the left of this rests on the truncated upper edge of one of the subradials, and these connect with others above, that form the base of the probosciform ventral extension. Second radials very small and short, or scarcely more than filling the sinuses in the first. Third radials nearly as wide as long, quadrangular and only about half as wide as the first radials. Fourth radials a little larger than the third, pentagonal in form, and supporting the arms on their superior sloping sides.

Arms slender, rounded and proportionally long, bifurcating first above the last radial, generally on the third or fourth piece, above which each of the subdivisions bifurcates again several times. Arm pieces generally about as wide as long, and not wedge shaped.

Probosciform extension at least half (and perhaps more than half) as long as the arms, entirely lateral, and not more than half as wide as the body, below; apparently somewhat thicker above. Body plates not convex, but merely granular, and joined by close fitting sutures. Column slender, round, and composed of nearly equal moderately thick pieces, near the base.

Height to top of first radial pieces, about 0.15 inch; breadth, 0.24 inch; length of arms, about 0.95 inch.

This is one of those few intermediate types such as we occasionally meet with in various departments of Natural History, when extensive collections can be studied, connecting or standing, as it were, intermediate between two genera. That is to say, it combines some of the characters usually regarded as belonging especially to *Poteriocrinites* with others equally characteristic of *Cyathocrinites*. Its body has much the usual form of *Cyathocrinites*, with the double alternating series of anal pieces precisely as we see in *Poteriocrinites*. On the other hand, it has the narrow, decidedly lateral probosciform ventral extension of *Cyathocrinites*, and might, with almost equal propriety, as far as we yet know, be called *Cyathocrinites? perplexus*. The existence of such a type would, in the estimation of some naturalists, be regarded as a sufficient reason for uniting the genera *Poteriocrinites* and *Cyathocrinites*. In this opinion, however, we cannot concur, for we believe that if all the genera thus connected by a few obscure forms were united, it would be found impossible to fix any limits whatever to such groups, with all the extinct types before us. Possibly characters may be found, however, warranting the establishment of a new genus for such forms.

Specifically this little Crinoid seems to be most nearly allied to our *Cyathocrinites? enormis*, but it differs in the number and arrangement of its anal pieces, as well as in having its arm pieces scarcely one-half as long in proportion to thickness.

*Locality and position.*—Lower part Burlington group of the Lower Carboniferous, Burlington, Iowa. No. 264 of Mr. Wachsmuth's collection.

### Subgenus SCAPHIOCRINUS, or GRAPHIOCRINUS.

#### SCAPHIOCRINUS RUDIS, M. and W.\*

Body much depressed, about four times as wide as high, flat or a little concave below, the flattened part including the basal, subradial, and about half the length of the first radial pieces. Base very small, a little impressed, and entirely hidden by the column. Subradial pieces of moderate size, extending out horizontally from the column; the one on the anal side, however, curving up distinctly, and the others slightly, at the ends; all flat, excepting the curvature mentioned, and pentagonal in outline (the superior angle being rather salient), excepting the one on the anal side, which is hexagonal, being trun-

---

\* Although we write the names *Scaphiocrinus* and *Zocrinus* in this paper for the sake of brevity, as if they were regarded as distinct genera, we really use them as subgeneric names under *Poteriocrinites*, as already explained.

cated above for the reception of the anal piece. First radial pieces three or four times as large as the subradials, twice as wide as long, very tumid in the middle, and pentagonal in form, the lateral margins being longer than the inferior, and the superior one straight, and equaling the entire breadth. Second radial pieces of about the same size as the first, which they equal in breadth below, though they are a little longer, and proportionally narrower above, and have each a strong angle down the middle of the outer side; all pentagonal in outline (excepting the anterior one, which is quadrangular), the superior angle being salient; each supporting two arms on the superior sloping sides, excepting the anterior one, which bears but a single arm.

Of anal pieces one only is included as a part of the walls of the body, and this one rests upon the upper truncated edge of the largest, curved subradial, and connects on each side with a first radial. Succeeding anals unknown.

Arms moderately strong, simple, angular on the dorsal side, and composed of short wedge shape pieces, alternately projecting out laterally on each side, in the form of spine-like processes. Column small, round, and composed near the base of pieces of moderate thickness, with each a projecting ridge around its middle, and perforated by a minute round canal. Sutures between the first and second radial pieces widely gaping when the arms are folded up vertically.

Height of body, 0.08 inch to the top of first radials; breadth, 0.33 inch; length of remaining portions of arms, about 0.85 inch; thickness of column at base, 0.17 inch.

This belongs to the typical section of *Scaphiocrinus*, as it has but a single anal piece included as a part of the body, and all its arms are simple. Specifically it appears to be most nearly allied to *S. spinobrachiatus*, Hall (Bost. Jour. Nat. Hist. vol. vii, p. 306), but differs in having its body much depressed, more flattened below, and its base is so much smaller as to be entirely hidden by the column, instead of projecting out around it. Its subradial pieces also differ in not being more elevated than the others, nor impressed at the angles. The arms in the specimen from which our description was drawn up, are not quite complete at their ends, though from a slight tapering and appearance of a tendency to curve together toward their extremities, it seems to be quite probable that they were not more than an inch in length, while those of the species *spinobrachiatus* are said to be about three inches in length, in the original specimen, and still imperfect at the ends.

*Locality and position.* Upper division of the Burlington group, Burlington, Iowa. Lower Carboniferous. No. 275 of Mr. Wachsmuth's collection.



Surface finely granular. Column round, moderately stout and composed of rather thin pieces, of uniform size near the base, with a rather small, round or subpentagonal central canal.

Length of body below the summit of the first radial pieces, 0.40 inch, breadth about 0.50 inch. Diameter of column at base, 0.18 inch. Entire length of arms unknown, as they are all broken at the extremity, with the remaining portion measuring 3.40 inches in length, with thickness of about 0.10 inch throughout.

This species has the long straight arms, obconic body, protuberant base, and general physiognomy of the typical forms of *Poteriocrinites*, but differs in having but two primary radial pieces to each ray, with the sutures between them somewhat gaping, as in *Scaphiocrinus*. Specifically it is not closely allied to any of the other known species. In the form of its body it is most nearly allied to our *Pot. subimpressus*, which Mr. Wachsmuth has ascertained probably has only two primary radial pieces to each ray, and hence seems to fall into *Scaphiocrinus*, giving that group the wide limits usually admitted. The species here under consideration, however, will be readily distinguished from the *Pot. (Scaph.) subimpressus*, by not having its body plates impressed at the corners, and all distinctly thinner, as well as by its less robust general habit.

*Locality and position.* Lower beds of the Burlington group, Burlington, Iowa. Lower Carboniferous. No. 277 of Mr. Wachsmuth's collection.

#### SCAPHIOCRINUS NANUS, M. and W.

Body very small, expanding rapidly from the column to the top of the first radials, where it is about once and a half as wide as high. Base small, slightly projecting, pentagonal in outline, and nearly covered by the round, flat facet for the attachment of the column. Basal pieces showing a very short, minute pentagonal facet above the column. Subradial pieces a little wider than long, three with a pentagonal outline, and two on the anal side hexagonal, there being no well defined angle visible at the middle of the under side of any of them. First radials of about the size of the subradial pieces, a little wider than long, pentagonal in form, and somewhat rounded on their outer sides, in consequence of the sutures between them being impressed. Second radials longer than wide, or nearly twice as long as the first, all pentagonal in outline and rounded and more or less constricted in the middle, each supporting two arms on its upper sloping side.

Anal pieces consisting of a double alternating series, the lowest one of which rests between the upper sloping sides of two of the subradials, and supports one side of the first radial on the right, while on its left it connects, above the middle, with another anal resting upon the truncated upper side of one of the subradials, and connecting on its left with the first radial on that side; above these three or four other pieces are seen between the arms extending up and joining with the base of the so-called proboscis.

Arms somewhat rounded on the dorsal side, each bifurcating on the sixth or seventh piece above the second primary radials, and composed of wedge form pieces that are a little longer than wide on the longer side. Above the bifurcations these pieces are somewhat constricted and each one projecting laterally above, on its longer side, for the reception of the pinnulæ, so as to present a rather zigzag appearance. Pinnulæ moderately stout, and rather distantly separated from each other; composed of joints a little more than twice as long as wide.

Surface of body plates even, and finely granular.

Height of body, 0.10 inch, to top of first radial pieces, where it measures about 0.20 inch in breadth. Arms about 0.75 inch in length.

In size and general appearance this species is quite similar to *S. dichotomus*, of Hall, with which it also agrees in having its arms bifurcating but once above their origin on the second radials. It differs, however, in having its second radial pieces rounded instead of angular, and distinctly longer in proportion to 1869.]

breadth, as is also the case with all the arm joints. It also differs in having two arms to each ray, all around, instead of only one in the anterior ray, as well as in the number of pieces in each arm below the bifurcations. Its arms are likewise proportionally more slender.

*Locality and position.* Lower division of the Burlington group, at Burlington, Iowa. Lower Carboniferous. Mr. Wachsmuth's collection.

**SCAPHIOCRINUS STRIATUS, M. and W.**

Body below the top of the first radial pieces subhemispherical, being regularly rounded below; composed of thick plates, which are ornamented with distinct, somewhat broken striae, running vertically, so as to radiate from the base, but all parallel with each other on each individual plate. Basal pieces hidden by the column externally. Subradials about as wide as long, five of them showing a pentagonal outline (there being no visible angle at the middle of their bases on the outside), and one on the anal side hexagonal, the latter being a little larger than the others. First radial pieces slightly shorter than the subradials, but about once and a half as wide, all having a general pentagonal form, being broadly truncated their entire breadth above, and having the articulating surfaces each marked with two very distinct transverse furrows. First anal piece a little longer than wide, hexagonal in form, and resting upon the truncated upper end of the odd subradial between two of the first radials, beyond which it projects nearly half its length; truncated above for the reception of a second anal. Other parts unknown.

Sutures distinctly channelled, so as to impart a moderate convexity to the plates.

Height to top of first radials, 0.20 inch; breadth, 0.46 inch.

This is a typical *Scaphiocrinus*, as far as its parts are known, and seems to be most nearly related to *S. simplex*, of Hall, from which it may be at once distinguished, however, by its channelled sutures, convex plates and peculiar sculpturing.

*Locality and position.* Lower Burlington beds, of the Lower Carboniferous, at Burlington, Iowa. No. 274 of Mr. Wachsmuth's collection.

**SCAPHIOCRINUS PENICILLUS, M. and W.**

Body small, somewhat basin shaped, or about three times as wide as the height to the top of the first radial pieces, truncated and a little concave below. Base very small, and nearly or quite hidden by the column in the shallow concavity of the under side. Subradials generally wider than long, with a pentagonal outline, excepting one on the anal side, which has the upper angle a little truncated, so as to make a sixth angle; there is doubtless also another

sometimes also the second arm pieces a little longer than wide, and slightly constricted: other arm pieces generally wider than long and well rounded, but not arranged so as to impart a zigzag appearance to the arms. The joints small, nearly or quite round, and composed near the base of alternating thin and thick pieces.

Height of body to top of first radial pieces, 0.07 inch; breadth, 0.10 inch; length of arms, about 0.70 inch.

This little species seems to be nearest like *S. dichotomus* Hall (Trans. Acad. Philad. p. 553), with which it agrees in size and general appearance. It will be readily distinguished, however, by the more frequent bifurcations of its arms, which also differ in being more rounded and composed of proportionally larger pieces, not arranged so as to present a slightly zigzag appearance as in the species *dichotomus*. It will also be distinguished from the last by having two arms to each ray all around, as well as by its concave base.

*Locality and position.* Upper division of the Burlington group at Burlington, Iowa. Lower Carboniferous. No. 286 of Mr. Wachsmuth's collection.

#### SCAPHIOCRINUS TETHYS. M. and W.

Body under medium size, expanding rather rapidly from the column to the top of the first radials, where it is about one-fourth wider than high. Base small, twice to three times as wide as high. Basal pieces very small, wider than high, and pentagonal in form. Subradial pieces slightly wider than high, pentagonal, excepting two on the anal side, which are hexagonal, meeting at a well defined angle at the middle of the base of any of them. First radials larger than the subradials, a little wider than long, and all greater than the second radial pieces rather more than twice as wide as long. All pieces are constricted in the middle, and somewhat expanded at the ends. All pentagonal in outline, and each supporting two arms on its superior sloping sides.

Anal series consisting of two alternating vertical ranges of pieces, the first of which rests between the two upper sloping sides of two of the subradials, and supports an inferior sloping side of the first radial on the right, while the second above the middle connects with another anal resting upon the first radial on the upper side of one of the subradials, and connecting with the first radial on the right. Above these one or two ranges of similar pieces join with those resting on the base of the so-called proboscis.

Arms not positively known to bifurcate after their origin on the subradial pieces. Composed of joints, the lower of which are small, rounded, and meeting at a well defined angle, and rounded or subangular, and narrower in the middle than at the ends. Above these the pieces gradually become shorter, and more rounded, and expanded at the ends, with the upper lateral extremity of each joint projecting alternately on opposite sides, so as to present a distinct zigzag arrangement, the projection being for the support of the pinnules. The pinnules are jointed, but rather stout, and composed of joints two or three times as long as wide, and provided with deep ambulacral furrows within.

Column comparatively rather stout; subpentagonal near the base, and becoming rounded below; composed below of small pieces, about one-third as thick as wide, but gradually becoming thicker near the top of the body.

Length of body to top of first radial pieces, 0.17 inch; breadth, about 0.10 inch; length of arms, about 1.10 inch.

This species is related to that we have here described under the name *S. scaphiocrinus*, but not only differs in having longer arms, but in having its arm joints much longer in proportion, as well as in presenting a more strongly zigzag arrangement. Its base is also more pinnate, and the sutures between its body plates slightly impressed instead of convex.

*Locality and position.* Upper division Burlington group at Burlington, Iowa. Lower Carboniferous. No. 298 of Mr. Wachsmuth's collection.

## SCAPHIOCRINUS DELICATUS, M. and W.

Body very small, somewhat cup-shaped, once and a half as wide as the height to the top of the first radials; sides expanding rapidly upward from about the middle of the subradials to the top of the first radial pieces, and rounding under to the column below. Base very small, and nearly hidden by the column, pentagonal in general outline. Basal pieces merely appearing as minute trigonal facets around the top of the column, and curving upward a little at the extremity. Subradial pieces of comparatively rather large size, three or four of them hexagonal (counting a very obtuse angle at the middle of the under side), and one or two heptagonal. First radial pieces of about the size of the subradials, but shorter and wider, and all pentagonal in form; facet of each for the reception of the second radials not occupying the entire breadth above, and sloping outward. Second radials full twice as long as wide, measuring the breadth at the widest part of the lower end; slender and rounded in the middle, and enlarged at the ends, particularly below; each supporting two arms on their upper sloping sides.

Anal plates arranged in a double alternating series, exactly as in the last described species. Arms slender, rounded, and composed of joints, the lower of which are about twice as long as wide, but those above gradually growing shorter, until they become scarcely longer than wide, on the longer side; and owing to their oblique arrangement and projections for the support of the pinnulae, presenting a zigzag appearance. At least one of the posterior arms seen to bifurcate on the seventh piece. Pinnulae rounded, comparatively rather stout, composed of joints two or three times as long as wide, and owing to the length of the arm-pieces, widely separated from each other. Column of moderate thickness, and apparently showing a tendency to assume a pentagonal outline near the base.

Height of body to the top of first radial pieces, 0.10 inch; breadth of do. 0.15 inch; length of arms about 0.75 inch.

This very delicate little species is nearest like that we have already described under the name *S. nanus*, but will be readily distinguished by its much more slender second radial pieces and arms. This narrowness of the second radials causes the intervening spaces to be wider than the second radial pieces themselves; while in the *S. nanus* these pieces are so wide as to be in contact with each other all around, excepting on the anal side. These differences give to each of these two forms more strongly marked distinctive features than would probably be apparent from merely reading the descriptions without seeing the fossils themselves.

*Locality and position.* Upper division of the Burlington group, at Burlington, Vt. Lower Cambrian series. No. 297 of Mr. Wadsworth's collection.

Arms round, rather slender, and after their origin on the third primary radials, bifurcating on the seventh, ninth or eleventh pieces in the different arms seen, and beyond this, one arm is observed to bifurcate on the nineteenth piece above; all composed of slightly wedge-formed pieces, a little wider than long.

Proboscis (so-called), as observed nearly flattened by pressure, two-thirds as wide as the body, and about four-fifths as long as the arms; not expanded at the summit; composed of moderate sized hexagonal pieces indented (and probably perforated) at the corners. Column subpentagonal near the base, where it is composed of alternately thicker and thinner pieces, with a small apparently pentagonal canal.

Height of body to top of first radials, 0.20 inch; breadth, about 0.40 inch; length of arms, about 2.10 inches. Length of proboscis above first radials, 1.70 inches; thickness of column at its connection with the base, 0.15 inch.

This species is related to such forms as *S. carinatus* and *S. dichotomus*, Hall; *S. rusticus*, White, and *S. Wachsmuthi*, M. and W., but differs from them all too clearly to render a comparison necessary.

*Locality and position.*—Upper division of the Burlington group, at Burlington, Iowa. Lower Carboniferous. No. 295 of Mr. Wachsmuth's collection.

#### SCAPHIOCRINUS SCALARIS, M. and W.

Body small, somewhat cup-shaped, being broad below, and a little expanded above; about twice as wide as high at the top of the first radials. Base small and hidden by the column in the concavity of the under side. Subradial pieces tumid, wider than high, and arranged so that the body rests upon them, when placed on a plane surface with the column removed; all appearing as if pentagonal, excepting the two on the anal side, which seem to be hexagonal, but they must all have each an additional obtuse angle at the middle of the under side. First radials about of the same size as the subradials, wider than long and pentagonal in form, though one on the anal side has one side so short as to appear as if quadrangular; each a little expanded above, so as to present, with the broad excavations at their inferior lateral angles, a more or less constricted appearance. Second radials smaller than the first, rounded on the outer side, and a little constricted on the lateral margins, all wider than long, with a quadrangular outline. Third radial pieces in all but the anterior ray nearly as large as the first, but proportionally longer, rounded on the outer side, constricted in the middle, and pentagonal in form; the superior lateral sloping sides of each supporting an arm. In the anterior ray the third piece is narrow and long, truncated above, and merely supports a single arm.

First anal piece smaller than the subradials, pentagonal in form, and resting between the upper sloping sides of the two hexagonal subradials; connecting on the left with the second anal, and on the right with a first radial, while it supports one side of another anal above. Second anal of nearly the same size as the first, and resting upon the superior truncated side of the subradial below. Above these, two alternating series of anal pieces are seen extending upward, to connect with the base of the so-called proboscis.

Arms nine, simple from their origin on the third radials, rather angular on the back, and each composed of short wedge-formed pieces, arranged somewhat in zigzag, with their longer ends alternately on opposite sides, and projecting so as to support stout, rounded pinnulæ, composed of joints sometimes nearly as long as wide. Pinnulæ very regularly arranged, so as to leave intervening spaces scarcely of their own breadth, and so stout as to present rather the appearance of armlets, than what are usually called tentacles, in the descriptions of fossil Crinoids; all like the arms with the ambulacral furrows comparatively deep and large.

Vault unknown; proboscis (so-called) about half as long as the arms, comparatively rather slender until at the upper extremity, where it is suddenly expanded to nearly twice its breadth below, and somewhat flattened on top. The

expansion, however, seems to be mainly due to the greater thickness of the plates here, than to a corresponding increase in the size of the cavity within. Plates of the proboscis of moderate size, and all indented at their corners.

Height of body to the top of first radial pieces, 0.18 inch; breadth about 0.32 inch; length of arms beyond the top of the third radials, 1.66 inches; length of proboscis above the first radials, 0.95 inch.

This species is so distinct from all others known to us, that it is scarcely necessary to compare it with any of them. It seems to be most like *S. Halli*, Hall, but differs in having its subradials so tumid as to give the body a truncated appearance below, instead of an inversely campanulate outline. Its pinnulae are also much stouter and less oblique, while its arms are entirely without the little flattened spine-like projections along their backs seen in that species. The stout pinnulae as seen extending between the arms present, with the latter, a peculiar scalariform appearance, that suggests the specific name.

*Locality and position.* Upper division of the Burlington group, at Burlington, Iowa. Lower Carboniferous. No. 282 of Mr. Wachsmuth's collection.

#### SCAPHIOCRINUS FISCELLUS, M. and W.

Body very small, somewhat cup-shaped, about once and a half as wide as high, rather broad and subtruncated below, with moderately expanded sides. Base very small, flat, and hidden by the column, when the latter is attached. Subradial pieces convex, curving under to connect with the base and extending about half way up the sides, three of them presenting a pentagonal outline, and two hexagonal, (that is without counting a very obtuse angle doubtless existing at the middle of the under side of each, but hidden by the column). First radials about the size of the subradial pieces, and pentagonal in form, the upper side always truncated the full breadth. Second radials quadrangular, constricted in the middle, and expanded at the ends, separated from each other by spaces nearly half their own breadth, measuring at the middle. Third radial pieces a little longer and narrower than the second, abruptly dilated at the ends, and strongly contracted in the middle; each, with apparently the exception of one in the anterior ray (which seems to bear only one arm), supporting two arms on their superior strongly sloping sides.

Anal plates forming a double alternately arranged series, exactly as in the last. Arms apparently simple from their origin on the third radials, composed of pieces as long as wide, or a little longer, and angular on the dorsal side; each piece always contracted in the middle, and expanded at the ends, particularly at one of the upper lateral corners alternately on each side of the arm, for the reception of the pinnulae, thus giving the arms a zigzag appearance. Pinnulae rather stout, and composed of pieces about as long as wide.

Surface of the body with deep indentations at the corners of all the plates, so as to form a comparatively strong ridge radiating to each side of the subradial pieces, to connect with a similar one on each of the adjacent pieces.

Height of body about 0.11 inch to the top of the first radial pieces, where it measures about 0.17 inch in breadth; length of arms, about 0.95 inch.

This species is nearly related to the last, but in addition to being much smaller, it differs in the strong radiating costae of its body plates, as well as in having its subradial plates merely convex, instead of tumid. Its arms, and also differ in being proportionally longer, and contracted in the middle.

*Locality and position.*—Lower division of the Burlington group, Burlington, Iowa. Lower Carboniferous. No. 283 of Mr. Wachsmuth's collection.

#### SCAPHIOCRINUS JUVENIS, M. and W.

Body small, expanding rather rapidly from the column, or presenting a short, obconic form, with rather distinct sinuses between the radial series, nearly twice as wide at the top of the first radials, as the height to the same point. Base small and short, or several times wider than high, but projecting

[July

below the subradials, truncated about three-fourths its breadth by the facet for the attachment of the column. Basal pieces nearly twice as wide as long, and pentagonal in form, but owing to the shortness of the lateral margins appearing nearly trigonal. Subradial pieces a little wider than long, three pentagonal, and two on the anal side hexagonal (without counting a scarcely defined angle at the middle of the under side of each). First radial pieces of about the size of the subradials, generally wider than long, and pentagonal in form. Second radials about as long as wide, distinctly rounded on the dorsal side, and quadrangular in outline. Third radials somewhat larger than the second, more or less expanded at the upper end, and rounded and contracted in the middle; each bearing two arms on its superior sloping sides.

Anal plates forming a double alternating series of five or six pieces, as in the last; the lowest piece resting between the upper sloping sides of two of the subradials, partly under the first radial on the right, and connecting on the left above the middle, with another piece resting upon the upper truncated edge of one of the subradials, and joining the first radial on the left.

Arms ten, simple from their origin on the third radials, composed of somewhat wedged-formed pieces, about as long as wide on the longer side, which projects above, alternately on opposite sides of the arms, for the reception of the pinnulæ, so as to present a somewhat zigzag appearance. Pinnulæ stout, arranged at intervals of near their own breadth apart, and composed of joints that are about as long as wide. Surface granular; body plates even, and merely separated by linear sutures. Column of comparatively moderate size, faintly subpentagonal, near the base, and composed of rather thin, nearly equal plates, with a very small central perforation.

Height of body to the top of first radial pieces, about 0.12 inch; breadth, 0.25 inch; length of arms, about 0.75 inch; thickness of column at base, near 0.07 inch.

This species is related to the last two, but is readily distinguished by the more conical form of its body, produced by the protuberance of its base, as well as by having two arms to each ray all around, instead of only one in the anterior ray. It also differs from both in having its body plates even, instead of very convex, or tumid, as in *S. scalaris*, or costate, as in *S. fiscellus*.

*Locality and position.*—Lower division of the Burlington group, at Burlington, Iowa. Lower Carboniferous. No. 284 of Mr. Wachsmuth's collection.

#### SCAPHIOCRINUS NOTABILIS, M. and W.

Body large, obconic, or expanding gradually from the column to the middle of the first radials, at which point these pieces are protuberant, so as to give the general outline, (as seen in a side view) a tendency towards an inverted bell-shape. Base of a deep cup form, less than twice as wide at the top as the height, or about one-third as high as the body to the top of the first radials. Basal pieces higher than wide, and pentagonal in form, the lateral margins being longest. Subradial pieces nearly twice as long as the basal, hexagonal in form, excepting the two on the anal side, which are heptagonal. First radial somewhat larger than the subradial pieces, slightly wider than long, pentagonal in form, and each provided with a very profound sinus for the reception of the second radials, more than one-third as wide as its upper edge, and extending about half way down its outer side. Second radial pieces comparatively very small, or about one-third as large as the first; pentagonal in form, about as wide as long, rounded on the outer side, and so deeply inserted in the sinus of the first radials on a kind of shoulder-like projection, that their dorsal angle above scarcely rises beyond the upper margins of the first radials, each supporting two arms on its superior sloping sides, and separated from that of the next ray on each side, by an interrarial space of about one and a half its own breadth. Anal plates two and about half of the third, included as a part of the walls of the body, hexagonal in form, and having the usual arrangement of those of *Poteriocrinites*, in a double, vertical, alternating series.

1869.]

Arms very long, slender and rounded; one of them seen to bifurcate first on the sixth, two others on the eighth, and another on the tenth piece, above the second radials. Beyond these bifurcations it is evident from the number of slender branches seen, that there must be other subdivisions, but the specimen is not in a condition to show the details of the bifurcations. Arm pieces generally longer on the longer side than wide, but not arranged in zigzag, the first two of each arm twice as long as wide, and somewhat contracted around the middle. Probosciform extension very long, or nearly or quite equaling the length of the arms, and somewhat narrowed at the extremity.

Surface of the first radial plates strengthened by prominent, rounded, radiating costae, two of which diverge downward from the mesial prominence under the sinus for the second radials, to connect with others on the subradials, so as to inclose profound triangular pits at the upper corners of the latter, while two similar ridges run laterally on each side of the sinus, parallel to the upper margin, to connect with those similarly situated on each adjacent first radial. On each subradial, the ridge extending down the middle widens and becomes nearly obsolete at the base, where it connects with several slender lines that continue on down converging toward the lower part of each basal piece; there being no pits or impressions at the meeting of the corners of the basal and subradial pieces.

Height of body to the top of the first radial, 0.96 inch; breadth across at the most protuberant part of the first radials, about one inch. Length of arms from their origin on the second radials, about four inches. Length of probosciform ventral extension, 3.85 inches.

This fine species departs very widely from the typical forms of *Scaphocrinus* in its large size, obconic body, strongly costate body plates, long bifurcating arms, and particularly in having its second radial pieces so narrow in proportion to the first, as to be separated from each other by interrarial spaces wider than the second radial pieces themselves. Its anal series although including more pieces than we see in the typical *Scaphocrinus* (being like that of *Poteriocrinus* proper), does not differ from that of a large proportion of the species usually included in *Scaphocrinus*, with which the species agrees in having only two radial pieces to each ray.

Specifically it is related to such forms as *Cyathocrinus macropleurus*, Hall, and *Poteriocrinus obuncus*, White, but it differs too widely from these and all the other similar forms known to us, to render a comparison necessary. *Cyathocrinus macropleurus* was described from a specimen not showing either the anal pieces or second radials, or the arms, Mr. Wachsmuth has specimens, however, showing that it has several anal pieces, and two radials to each ray. He also has specimens of the *P. obuncus* (which was also described from a specimen not showing the arms and second radials), indicating that it agrees in these characters with *Scaphocrinus*. It is possible such species should form a separate section, or subordinate group.

*Locality and position*.—Lower division of the Burlington group, Burlington, Iowa. Lower Carboniferous. No. 303 of Mr. Wachsmuth's collection.

#### SCAPHOCRINUS CORZYI, M. and W.

Body of medium size, basin-shaped, or about twice as wide as high, rounded and distinctly concave below. Base small, and nearly or quite hidden by the column in the concavity of the under side. Subradial pieces comparatively rather large, curving under to connect with the base, all presenting a general hexagonal outline, excepting two on the anal side, which are heptagonal; they must each, however, have another obscure angle below. First radial pieces about equaling in size the subradials, but proportionally wider, being sometimes slightly more than twice as wide as long, all pentagonal in form, the upper side being much the longest, and the lateral margins short. Second radials a little longer than the first, but narrower above, and more or less con-

[July

stricted around the middle ; pentagonal in form, the upper angle being rather salient, and each supporting an arm on each of their superior sloping sides. First anal piece about one-third as large as one of the subradials, hexagonal in form, and resting between the upper sloping sides of two of the subradials, and partly under one side of one of the first radials on the right ; while it supports another anal piece above, and connects with a third on the left, which rests upon the upper truncated side of one of the subradials.

Arms moderately long, carinated along the middle of the outer side, and after the first division on the second radials dividing again on the sixth or eighth piece, beyond which they are all simple ; each composed of alternating wedge-shaped pieces, which are a little wider than long, and each projecting on alternate sides above for the reception of tentacles, which are stout, angular, and composed of pieces nearly twice as long as wide.

Breadth of body, 0.55 inch ; height to top of first radials, about 0.20 inch.

This species is remarkable for the curious rough appearance of the arms, produced by the projection of the pieces alternately on each side, and the interruption of the carina along the dorsal side, which is not continuous, but looks as if the pieces had been slipped a little alternately to opposite sides.

*Locality and position.*—Crawfordsville, Indiana. Keokuk division of the Lower Carboniferous.

### Subgenus ZEACRINUS.

#### ZEACRINUS SCOBINA, M. and W.

Body very much depressed, or about four times as wide as high, to the top of the first radial pieces, and concave in the middle below. Base small, and hidden by the column in the concavity of the under side. Subradial pieces curving in to the concavity of the under side, and extending outward around the column ; all presenting a nearly pentagonal general outline, with short lateral edges, excepting the one on the anal side, which seems to be hexagonal, (each being without a visible angle at the middle of the under side). First radials three or four times as large as the subradials, near twice as wide as long, pentagonal in form, with lateral and inferior margins of nearly equal length, and upper edge equaling the entire breadth. Second radials as wide as the first and nearly twice as long, all pentagonal in form, the superior angle being salient, and also projecting outward, while a strongly defined mesial angle extends down the middle of the dorsal or outer side to the base of each, the surface on each side of this angle being distinctly concave.

Anal pieces small, and owing to the rough surface of the plates, and the indistinctness of the sutures, without very clearly defined outlines. As near as can be made out, the first one seems to be somewhat cuneiform, and wedged in obliquely under one side of the first radial on the right ; on its left it connects above the middle, apparently with another resting upon a very short upper side of one of the subradials. Above these other anal pieces are seen between the arms, but their exact arrangement cannot be made out from the specimen studied.

Arms, after their origin on the second radials, each bifurcating on the sixth piece (excepting those of the anterior ray, which divide first on the eleventh piece), the inner division of each being smaller than the other, and remaining simple ; while the outer or main arm gives off another division on the inner side on the eighth piece above the first bifurcation, and still another on the ninth or tenth piece above the latter, which is as far as the arms can be clearly traced in the specimen, though there is some appearance of a fourth bifurcation in one of the arms. Arm pieces short, or from twice to three times as wide as long, and not in the slightest degree wedge-shaped ; each with lateral edges sharp and a little projecting, and provided with a little pointed process on the middle of the dorsal side. These little asperities, and the beveled character of the sutures between the arm joints, give the arms a rough,  
1869.]

rasp-like appearance, which has suggested the specific name. The body plates are also rendered very rough by a ridge extending from the middle of the upper edge of each first radial to connect with others on the subradials, and the presence of other irregular asperities. Sutures between the first and second radials widely gaping when the arms are folded together. Column of moderate size, and composed of thin, nearly round pieces with projecting rough edges, and a rather small subpentagonal central perforation.

Height of body to the top of the first radials, 0.10 inch: breadth, about 0.42 inch, length of arms about 1.70 inch.

This species is related to *Zeacrinus perangulatus*, of Dr. White, but differs in having its arms longer and less tapering, as well as bifurcating more frequently, also in having each inner division of each arm smaller than the outer. The bifurcating pieces of its arms are likewise proportionally smaller, and not protuberant as in that species. In the species *perangulatus* the arm pieces are also merely angular along the middle, while in that under consideration there is, instead of a continuous angle, a row of little pointed isolated protuberances, presenting a crenate appearance as seen in outline.

*Locality and position.* Upper division of the Burlington group, Burlington, Iowa. Lower Carboniferous. No. 321 of Mr. Wachsmuth's collection.

#### ZEACRINUS ASPER, M. and W.

Body small, much depressed, or twice and a half as wide as high, broadly truncated and concave below, the concavity including the base and about half the length of each subradial piece. Base small and nearly or quite hidden by the column. Subradial pieces very abruptly geniculated in the middle, the lower or inner half forming a part of the concavity of the under side, and the upper a part of the outer wall of the body, while their prominent middle forms the margin of the concavity below, each presenting a pentagonal outline excepting one on the anal side, which is hexagonal. First radial pieces about twice as long as the subradials, and twice as wide as long, all pentagonal in form, with the upper truncated side equaling the full breadth. Second radial pieces as wide and once and a half as long as the first, pentagonal in form (unless the anterior one, which has not been seen, may be an exception) and supporting the arms on their superior sloping sides, each with a very prominent sharp carina extending up the middle, while the surface on each side of the carina is deeply concave, excepting at the lower margin, along which there is also a transverse ridge or carina.

Anal plates arranged as in the last described species, in a double alternating series, the lower one being placed obliquely under one side of the first radial on the right while the next rests upon a short end of one of the subradials, the two connecting together and supporting the others above.

Arms, after their origin on the second radial pieces, each bifurcating on the sixth piece, the two divisions of each being of equal size, but the inner one is simple, while the outer bifurcates again on the sixth, seventh, eighth or ninth piece above the first division, beyond which the two equal divisions are simple as far as they can be traced in the specimens examined. Arm pieces short, or nearly twice as wide as long, wedge form, and each strongly projecting on the longer side, alternately so as to present a zigzag appearance, bifurcating pieces all larger than the others, and extending out, on the dorsal side of the arms into pointed prominences, sometimes assuming the character of short spines, which with the lateral processes of the other pieces, gave the arms a very rough, harsh appearance.

Surface of the body plates with deep excavations at the corners, and strong ridges or carinae between the excavations. Of these carinae, two descend diverging from the middle of the upper side of the first radials (along which there is also a transverse ridge), to connect with others on the subradial pieces. Sutures between the first and second radial pieces very widely gaping. Column round and very slender near the base, where it is composed of pieces

[July,

of moderate thickness, every alternate or third one of which projects out distinctly beyond the others. Central canal minute and apparently round.

Height of body to the top of the first radial pieces, 0·10 inch; breadth, 0·31 inch; length of arms, about 1 inch.

This is another species related to *Zeacrinus spinobrachiatus*, of Dr. White, but it differs in having decidedly more slender arms below the bifurcations, with the arm pieces, particularly above the first bifurcation, arranged much more in zigzag, and their thicker ends more projecting on each side. It is one of the forms combining some of the characters of *Zeacrinus* and *Scophiocrinus*.

*Locality and position.* Upper division of the Burlington group, Burlington, Iowa. Lower Carboniferous. No. 323 of Mr. Wachsmuth's collection.

#### ZEACRINUS SERRATUS, M. and W.

Body small, much depressed, or about three times as wide as high, broadly truncated and concave below. Base very small, and nearly or quite concealed by the column in the concavity of the under side. Subradials a little tumid, curving abruptly into the concavity of the under side, and extending about half way up the lateral walls of the body; three or four pentagonal and one or two on the anal side hexagonal (not counting a very obtuse angle doubtless existing at the middle of the under side of each). First radials somewhat larger than the subradials, nearly twice as wide as high, and all pentagonal in form, with the upper side equaling the entire breadth. Second radials as wide at the base as the first, and nearly twice as long, each pentagonal in form and supporting two arms, excepting that of the anterior ray, which is quadrangular and supports but a single arm; each with a prominent, well defined, sharp carina extending up the middle, and the dorsal surface on each side of this carina is distinctly concave. Anal pieces arranged in a double alternating series almost exactly as in the last.

Arms (excepting in the anterior ray) bifurcating first on the sixth piece above their origin on the second radials, the inner division being slightly smaller than the other, and simple to the end, while the outer division bifurcates again on the seventh piece above, and a third time on the eighth piece above the latter, the inner divisions being all simple. Arm pieces very short, or two or three times as wide as long, and scarcely showing any tendency to assume a wedge shaped outline; each one with a small pinched or angular projection on the middle of the dorsal side, giving the arms a subcarinated appearance; but these projections are not continuous, being separated by notches at the sutures between the pieces, and a little inclined upward, so as to impart to the dorsal side of the arms a serrated appearance, as seen in an outline lateral view. Axillary pieces at all the bifurcations of the arms larger than the other arm pieces, and more prominent and angular.

Surface of body plates merely convex, or somewhat tumid, and without costæ or carinæ. Column very small, round or subpentagonal, and composed, near the base, of nearly equal rather thin pieces, with a very minute central perforation. Sutures between the first and second radial pieces widely gaping.

Height of body, 0·07 inch; breadth, about 0·22 inch; length of arms, about 0·60 inch.

In several respects this species agrees almost exactly with *Z. ramosus*, of Hall, which has the same proportions, with its arms bifurcating in exactly the same way, and composed of similar short pieces, showing no tendency to a wedge formed outline. On comparison with the original typical specimen of that species, however, now before us, the species under consideration is found to differ in having its second radial pieces each provided with a sharp, strongly defined mesial carina, and the surface on each side of the carina distinctly concave, instead of having these pieces merely obtusely rounded. The same or a similar difference is also seen in the arm pieces, each of which is provided with one or more little projections on the dorsal side, instead of being smoothly

1869.]

rounded or somewhat flattened, as in *Z. ramorua*. If it were not for the fact that the typical specimen of *Z. ramorua* has the surface well preserved we would be led to think it might possibly have possessed the sharp carina of the second radials, and the projecting points of the arm pieces, seen in the species under consideration and that they might have been removed by accidental abrasion. The fact, however, that it has the surface of its arms, second radials and other parts so well preserved as to show the original fine granulations over the whole, demonstrates that it could never have possessed the characters mentioned in the species we have here described, and as we have never seen varieties of a species, in this or any of the allied groups differing to this extent in such characters, we can but regard the differences as being specific.

It will be observed that the character of the arm and second radial pieces, mentioned as distinguishing this species from *Z. ramorua*, also occur in the species described in this paper under the name *Z. scolima*. That species, however, differs from this in having its first radials and subradial plates strongly costate, while its arms are proportionally longer and differ in being somewhat serrated on each side. It also differs in having two arms, instead of only one, from the anterior ray, as in this and more divisions in its arms, which divisions are given off at greater intervals.

*Locality and position.* Burlington group, at Burlington, Iowa. Lower Carboniferous. Mr. Wachsmuth's collection.

#### ZEACRINUS LYRA, M. and W.

Body short obconical, or expanding very rapidly from the column to the top of the first radial pieces, where it is about twice as wide as high. Base not concave but somewhat projecting, and about one-third as high as wide. Truncated near three-fourths its breadth by the slightly concave facet for the attachment of the column. Basal pieces presenting a small pentagonal facet above the column, two or three times as wide as long, with lateral margins so short as to appear nearly triangular. Subradial pieces of moderate size, about as wide as long, three hexagonal and two on the anal side heptagonal. First radial pieces generally about twice as large as the subradials, near or exactly half as wide as long, and all pentagonal, with the upper side equaling the entire breadth. Second radial pieces of very nearly the same size and form as the first, though the fifth angle and sloping sides are of course above instead of below, each supporting two arms all around. Anal plates nearly all hexagonal, and, as usual, arranged in a double alternating series, the first resting between the superior sloping sides of two of the subradials, under one side of the first radial on the right, and connecting above the middle on the left, with another resting on the superior truncated side of one of the heptagonal subradials, and joining the first radial on the left. Above these the others extend up to connect with the proboscis (so called).

Arms all distinctly rounded, and after their origin on the second radial pieces each bifurcating first on the fifth, sixth, seventh or eighth piece at which the outer division bifurcates or gives off an arm on the inner side, twice or three times at more or less nearly equal distances, all the inner arms continuing simple throughout their entire length, and equaling the outer divisions in thickness. Arm pieces short and very distinctly wedge formed, each having a moderately stout tentacle at its larger end, along the inner lateral margins of the arms; axillary or bifurcating pieces a little larger than the others, but not more convex. Tentacles composed of joints about twice as long as wide.

Body plates not convex, and merely separated by linear sutures which are not gaping even between the first and second radials; entire surface more or less granular.

Height of body to top of first radials, about 0.25 inch; breadth, about 0.50 inch; length of arms, apparently nearly 2 inches.

[July,

This species is related to *Poteriocrinus bursæformis*, of White, which has its body formed exactly as in *Poteriocrinus*, with its arms and primary radials presenting all the characters of *Zeacrinus*, as was noticed by Dr. White; thus showing, with the species under consideration and some others, that *Zeacrinus* can scarcely be regarded as more than a subgenus under *Poteriocrinites*. The form that we have here described differs, however, specifically from Dr. White's species, in having its body proportionally shorter and smaller. Its arms also differ in being very distinctly rounded instead of flat, while its anterior ray supports two arms directly on the second radial piece, as in all the other rays, instead of having the first bifurcation in that ray on the fourth piece.

The specimens are not in a condition to show much of the ventral prolongation, but one of them shows that it is very nearly as long as the arms, and somewhat expanded and crowned with short spines at the upper extremity.

*Locality and position.* Upper division of the Burlington group, at Burlington, Iowa. Lower Carboniferous. No. 319 of Mr. Wachsmuth's collection.

#### Genus ACTINOCRINITES, Miller.

In the second volume of the Illinois Reports, published in 1866, after admitting as distinct genera from *Actinocrinites* the groups *Megistocrinus*, *Agaricocrinus*, *Amphorocrinus* and some others, we also separated under the name *Strotocrinus* a group of remarkable American Carboniferous species, of which *Actinocr. perumbrosus*, Hall, was regarded as the type. At the same time that we made this separation there were amongst the collections before us specimens of another allied type, in regard to the proper disposition of which we were in considerable doubt. These belong to the group of which *A. ventricosus*, Hall, may be regarded as an example. We readily observed that while in some of their characters they agree most nearly with *Strotocrinus*, that in others they seemed to be more closely allied to *Actinocrinites*, and at one time we were very much inclined to the opinion that a strictly systematic definition of all the different genera of the *Crinoidea* would require their separation as a distinct intermediate genus. Wishing to avoid disturbing the existing nomenclature, however, as much as possible, we finally concluded to place this group provisionally as a section under *Actinocrinites*.

Since that time we have had an opportunity to study an extensive series of these and the allied groups, in Mr. Wachsmuth's collection, and have been led to the conclusion that if this type does not form a separate genus, holding an intermediate position between *Strotocrinus* and *Actinocrinites*, that it should be placed as a distinct subgenus under the former. Adopting this view, and admitting, as we have elsewhere done, that the *Batocrinus* and *Dorycrinus* groups should stand as distinct genera, the genus *Actinocrinites* would be left to include two sections;\* that is, the typical forms, such as Miller's *A. triacontadactylus* and *A. polydactylus*, and de Koninck's *A. stellaris*, *A. diversus*, *A. deornatus* and *A. armatus*, with various others; and the group including *A. multibrachiatus* and its allies.

The typical forms of *Actinocrinites*, which agree almost exactly with all the other genera mentioned, as well as with the *A. multibrachiatus* group, in the number and arrangement of the pieces composing the walls of the body below the bifurcations of the rays, are distinguished by the following characters, never found all combined in any one of the other groups:

In the first place, they have the arm bases, or brachial pieces, and adjacent parts (sometimes as far in as the third primary radials) grouped together so as to form five more or less protuberant lobes,† and so far as yet known to us, at

\* There are doubtless other sections, but we allude here to the forms we have had an opportunity to study.

† Since these remarks were in type, we observe, on consulting Miller's Nat. Hist. of the *Crinoidea*, to which we had not previously had access for many years past, that he seems to have confounded two very distinct forms under the one name of his typical species, *Actinocrinites triacontadactylus*. One of these, if correctly represented on plate I of his work, 1869.]

least a part of the arms bifurcating *after* becoming free, and always each composed of a single series of pieces below each bifurcation, as well as generally for some little distance above. They also combine with these characters a more or less produced central or subcentral tube or proboscis, and have the second primary radial pieces nearly always normally hexagonal.

The other group represented by *A. multibrachiatus* differs from the typical forms of *Actinocrinites* in having the arm bases arranged in a nearly or quite continuous series all around, and the arms *never* bifurcating *after* becoming free, as well as in nearly always having normally the same number of arms in each ray. The species of this group also more generally have the vault higher in proportion to the body below the arms, but there are a few exceptions to this in both groups. In a few species of typical *Actinocrinites* the arm bases are less distinctly grouped, and not so protuberant as in others, but so far as we have yet seen they can readily be distinguished by the structure and bifurcations of their arms where specimens retaining them can be seen and nearly always, even where the arms are broken away, by their wider interradian and anal sinuses and other peculiarities of general physiognomy, apparent enough to the eye but difficult to express in words.

In having the arm bases arranged in a nearly or quite continuous series all around and the arms never bifurcating after becoming free, the *A. multibrachiatus* group agrees with *Batocrinus*, but it differs from that group in having longer arms in proportion to the length of the proboscis, which in *Batocrinus*, when entire, protrudes from one-fourth to one half its entire length beyond the extreme length of the arms\*. They also differ from *Batocrinus* and agree with *Actinocrinites* in nearly always (perhaps always normally) having the second radial pieces hexagonal instead of quadrangular while their body plates are more or less sculptured (generally strongly so) into radiating costae, usually consisting of a single rib for each side of each plate, instead of having the plates even and smooth, merely convex or tumid. In short, the species of these two groups can be distinguished at a glance from specimens even showing the body only.†

As thus limited, the genus *Actinocrinites* would include, along with a number of foreign species, the following American Carboniferous forms.‡

1. *ACTINOCRINITES*, Miller Section (a).

*A. verrucosus* (= *A. asterius*, McC.), *A. chloris* (= *A. tenuisculptus*, McC.), *A. lobatus*, *A. Humboldtianus*, *A. jugosus*, *A. pernodosus*, *A. uniconstatu*, *A. Lewis*, *A. brontea*, &c., of Hall. Also, *A. Fandethi* and *A. multiradiatus*, Shumard. *A. Wachsmuthi*, White, and *A. scutellus*, M. and W. (= *A. rusticus* Hall, and *A. Sillimani*, M. and W.), as well as our *A. penicillus* and *A. delicatus*, of this paper, and *A. Indianensis*, L. and C., with perhaps several others with which we are not very well acquainted §

2. Section (b).

*A. multibrachiatus*, *A. proboscidiatus*,|| *A. exlatus*, *A. clavus*, *A. limbrachiatus*,

must belong to an entirely different species from that figured under the same name on his plate II as it is represented as having its arm-bases and contiguous parts, not forming five widely separated protuberant lobes but arranged more like those in the American section represented by such forms as *A. multibrachiatus*, though its arms clearly bifurcate *after* becoming free.

\* See figs 1 and 2, pl. II, Iowa Geol. Report, vol. 1, pt. II.

† See pl. X fig. 10, Iowa Geol. Report, vol. 1, pt. II. For other examples of this group see figs 13 & 14 same plate, where they may be compared with figs 7 & 8 of the same plate, representing two species of true *Actinocrinites*, with arm bases grouped into 5 protuberant lobes.

‡ There are some other described American species not mentioned in this list, which is only intended to include such species as we have had an opportunity to study.

§ Dr. Shumard's *A. concinnus* belongs here if not a *Stegocrinites*. We have not yet seen a specimen of it showing the rays far enough out to decide positively to which of these groups it belongs.

|| *A. quaternarius*, *A. quaternarius* var. *spiniferus* and *A. Themis*, Hall, are believed to be varieties of this *A. proboscidiatus*.

[July,

*A. ovatus*, *A. securus*, *A. opusculus*, *A. excerptus*, *A. infrequens*, *A. thalia*, *A. thetis*, *A. thoas*, *A. locellus*, *A. sexarmatus*, *A. reticulatus*, all described under *Actinocrinus* by Prof. Hall. Also, *A. Fosteri* and *A. Hurdianus*, McChesney, and our *A. longus* of this paper.

It is worthy of note that all the known Burlington species of this group came from the Lower Burlington beds, as has been determined by Mr. Wachsmuth, by careful observations continued through many years.

#### ACTINOCRINITES. Section (a).

##### ACTINOCRINITES PENICILLUS, M. & W.

Body small, inversely campanulate, or with sides expanding rapidly from the truncated base to the secondary radius, which with the brachial pieces curve a little outward. Base much depressed, or about four times as wide as high, broadly truncated and but slightly concave below; margin more or less expanded horizontally, and deeply notched at the sutures. First radial plates comparatively rather large, and about twice as wide as high. Second radials near half as large as the first, about twice as wide as high. Third radials a little larger than the second, wider than long, and pentagonal in form, the lateral margins being short, each supporting on each of its superior sloping sides a secondary radial of about its own size, which in its turn supports two free arms.

Anal pieces unknown above the second range; first one smaller (particularly narrower) than the first radials, and supporting two others of its own size in the next range. Interradial pieces three to five in each space; first one as large as the second radials, hexagonal in form, and bearing upon its upper sloping sides two smaller pieces, above which there is generally one or two minute pieces.

Arms free from their origin on the secondary radials, and composed below of slender rounded pieces, the first of which is about twice as long as wide, and more or less constricted in the middle; beyond this the lateral arm on each side of each ray is simple, with its second piece like the first, and followed by two or three other shorter wedge formed pieces before passing into a double series of small, alternately arranged pieces. Inner arms of each ray bifurcating on the first piece, and one of the subdivisions in one or both bifurcating again on the first piece, thus making from seven to eight arms to each ray, or from thirty-five to forty in the entire series. The single piece below and the first above each division, is slender, rounded, and more or less constricted, and generally two or three wedge formed pieces follow the latter before the commencement of the double series of alternating pieces, above which the arms are a little wider and of moderate length. Vault unknown; proboscis very slender at the upper end, and apparently of about the same length as the arms.

Surface of all the body plates deeply excavated at the corners, and prominent in the middle, the prominence of the first radials usually forming a transverse ridge, from which a single more or less defined vertical ridge ascends the second radials to the middle of the third, from which it bifurcates and continues to the secondary radials.

Height of body to the top of secondary radials, about 0.22 inch; breadth at the top of secondary radials, 0.40 inch; length of arms if straightened out, about 0.70 inch; breadth of do. at the widest part near the middle, 0.05 inch.

This little species is allied to *A. lucina*, Hall, which, before seeing specimens showing the arms, we had supposed to belong to the *A. multibrachiatus* group, but which is a true *Actinocrinites*. Our species differs, however, in having the arms more frequently and differently bifurcating, so as to make from thirteen to fifteen more in the entire series. Its arms also differ in not being subspinous on their margins.

1869.]

*Locality and position.* Lower Burlington beds of Lower Carboniferous, Burlington, Iowa. No. 38 of Mr. Wachsmuth's collection.

ACTINOCRINITES DELICATTS, M. and W.

Body small, subturberate, or widening rather rapidly from the somewhat truncated base to the top of the third radials. Base depressed, or about four or five times as wide as high, with slightly expanded margins notched at the sutures. First radial pieces of moderate size, a little wider than long, and, as usual, two heptagonal and three hexagonal. Second radial pieces a little smaller than the first, more or less regularly hexagonal, the superior lateral sides, however, being sometimes very short. Third radials about as large as the second, normally pentagonal, but sometimes with the lateral angles truncated so as to give them an irregular heptagonal outline. Secondary radials resting one upon each superior sloping side of each third primary radial, which they exceed in length; more or less prominent, curving outward, and generally constricted and rounded in the middle, though not entirely free from the walls of the body, excepting on the upper side; supporting on each of their superior (free) sloping sides the first divisions of the arms. First interrarial pieces about as large as the first radials, hexagonal, and supporting two smaller pieces in the next range, which connect with others above, belonging apparently more properly to the vault. First anal piece nearly as large as the first radials, heptagonal in form, and supporting in the second range two pieces, one of which (in the typical specimen) is as large as the first; above these there are four or five smaller irregular pieces in the third range, and above the latter others belonging apparently to the vault.

Arms slender, rounded, and composed below of distinctly constricted pieces longer than wide, and, after the first division on the secondary radials, the inner ones bifurcating on the second piece, and one or both of these subdivisions divide again on the second piece, above which they still continue to be composed of a single range of rounded pieces for a short distance and then pass gradually through a few wedge-formed pieces into a double series of alternating pieces, above this they are all a little stouter than below, and show a very slight tendency to become somewhat flatter toward their upper extremities. So far as can be seen, the two outer arms of each ray are simple from their origin on the secondary radials, and composed of a single series of rounded and constricted pieces as far up as the last bifurcations of the other arms, consequently there appear to be eight ultimate divisions, or arms, to each ray. (Vault unknown.)

Surface apparently minutely granular, and with a small, more or less defined ridge extending from the base up the primary radials to the third radial, on which it bifurcates and sends a branch to the base of each of the two main arms. On the first radials, as well as the anals, there is also some tendency to send off an obscure ridge across from one to another, on each side. None of the body plates are tumid, though they are generally very slightly convex.

Height of body from bottom of base to the top of secondary radials, 0.16; breadth, about 0.30 inch.

This species is related to *A. chloris*, Hall, but is much smaller, and differs in having its body, below the arms, merely rather rapidly expanding, with nearly straight sides, instead of being hemispherical. Its arms also bifurcate differently. In the *chloris*, for instance, they all (or at any rate, the inner ones), after their origin on the secondary radials, bifurcate once on the first piece beyond, while in our species the inner arms bifurcate on the second piece, and the outer of those subdivisions again on the second piece.

*Locality and position.*—Upper division of the Burlington member of the Lower Carboniferous at Burlington, Iowa. Mr. Wachsmuth's collection.

[July,

ACTINOCRINITES. *Section (b).*

## ACTINOCRINITES LONGUS, M. and W.

Body rather elongate-obconic below the arms, the sides expanding gradually, with a moderately convex outline from the base to the tertiary radial pieces, which, with the brachial pieces, curve very slightly outward. Base about twice and a half as wide as high, not thickened or expanded below, and but very slightly notched at the sutures; facet for the reception of the column large and moderately concave, with a rather large central perforation. First radials comparatively large, very nearly or quite as long as wide. Second radials scarcely half as large as the first, about as wide as long, quadrangular, pentagonal or unequally six-sided. Third radials of about the same size as the second, pentagonal, hexagonal, or heptagonal, and each bearing on its superior sloping sides two secondary radials of near its own size, each of which supports, on its outer sloping upper side, brachial pieces, leading to an arm, and on its inner side, above, a small tertiary radial giving origin to two arms, thus making three arms to each main division, and six to each ray, or thirty to the entire series. (Arms unknown.)

Anal plates five or six, the first being of the same size as the smaller first radials, hexagonal in form, and a little longer than wide; second anals two, about two-thirds as large as the first, and irregularly heptagonal or octagonal; above these there are two smaller pieces in the third range, and one or two still smaller pieces above the latter, the upper one being barely large enough to separate the posterior lateral brachial pieces of the two posterior rays. First interradial pieces about half as large as the first radials, heptagonal, and supporting two smaller pieces in the second range, above which there are one or two still smaller pieces in the third, and a minute piece over the latter, wedged in between the brachial pieces. In each interaxillary space there are usually two intercalated pieces, the lower of which is sometimes as large as one of the tertiary radials, while the upper is very small, and wedged in between the brachial pieces.

Vault conical, and nearly three-fourths as high as the body below the arms; composed of irregular pieces of moderate size, some of which project in the form of small pointed nodes or short spines, passing gradually into a rather large subcentral proboscis.

Surface of all the body plates rather distinctly convex, but not properly tumid, and showing but the faintest traces of an effort to form, on some of the smaller pieces, an obscure radiating ridge near each side. In most cases, however, these are entirely obsolete, and the plate seems to be merely evenly convex.

Height of body to arm bases, 1.20 inch; breadth of do. at arm bases, 1.40 inch; height of vault, about 0.80 inch.

In the structure of its body, as well as in its arm formula, this species agrees with *Actinocrinus clavus*, of Hall. It differs, however, greatly in form, as well as in the surface characters of its body plates, being rather elongate obconical below the arms, instead of "very broadly subturbinate, and spreading more rapidly above the third radial plates;" while its body plates are merely convex, instead of being "elevated into strong angular nodes, some sometimes marked by low ridges on the lower part," and by "strong angular ridges" on the upper part.

Its elevated conical vault, passing gradually into the nearly central proboscis, and narrow obconic body below the arms, give it a peculiar fusiform outline. In the nature of its vault it resembles quite nearly *A. costatus* of Hall, from which, however, it differs widely in other respects.

*Locality and position.*—Lower beds Burlington group of Lower Carboniferous, Burlington, Iowa. Mr. Wachsmuth's collection.

1869.]

## Genus STROTOCRINUS, M. and W. 1866.\*

Extending the genus *Strotocrinus* so as to include, as already suggested, the *Act. ventricosus* group as a subgenus, we will have, first, the typical urn-shaped species, such as *S. perumbrosus* and *S. liratus* with the structure of *Actinocrinites* up to the divisions of the rays, but with the body comparatively long and narrow below, and the secondary and other succeeding supplementary radials, brachial and intermediate pieces, connected laterally all around, and spreading out horizontally far beyond the limits of the body, so as to form, with the flat or much depressed vault, a broad, more or less distantly ten-angled disc, from the margins of which the numerous long, slender arms arise, without bifurcating after becoming free †. Indeed, with rare exceptions, the rays can scarcely be said to bifurcate, properly, after the division on the third primary radials, though each main division continues on out, throwing off alternately on each side brachial pieces in close contact with each other, until, at last, it terminates in a single free arm. Each of the arms commences abruptly as a double series of small alternating pieces immediately on the last fixed brachial piece, without an intermediate series of free single pieces extending entirely across. Some of the species, such as *S. perumbrosus* have but a very small simple opening situated subcentrally, or more or less excentrically towards the anal side, and penetrating the flattened vault obliquely, so as to be directed forward or away from the anal side while others, like *S. liratus*, have a long erect, subcentral tube, or so called proboscis, sometimes recurved at the end. The column is known, at least in the species provided with a proboscis, to be peculiar in being composed of very thin segments, a part of which, at regular intervals, project out beyond the others, and send up and down, at equal distances all around, five external, thickened processes or ribs, apparently as a natural provision to give it strength, without destroying its flexibility.

Then we have the *Act. ventricosus* group, which not only agrees with the *S. perumbrosus* section of *Strotocrinus* in having merely a very small subcentral or excentric opening in the vault, without any traces of a proboscis, but also, to a considerable extent, in the manner in which the subdivisions of the rays are given off, but differs in having these subdivisions not in contact so as to form a disc, but divided by narrow interradiat anal, axillary and sometimes interbrachial sinuses, the former of which often extend quite in to the body. The species of this group also differ from the typical forms of *Strotocrinus* in having the body shorter below the arms, and the vault generally more ventricose, and provided with external furrows radiating from the middle to the anal and interradiat sinuses. So far as yet known, the species of this type have rather stouter and less numerous arms than we see in *Strotocrinus* proper, but generally more than we see in *Actinocrinites*. In both groups of *Strotocrinus* the arms are, as in *Actinocrinites*, provided with numerous pinulae, or so-called tentacles, but here they seem to be always armed with minute spines directed more or less obliquely upward from their upper margins.

From *Actinocrinites* the *A. ventricosus* group not only differs in being without any traces of a proboscis, but in having its ventricose furrowed vault composed of numerous minute pieces, and the divisions of its rays, although not forming a continuous disc as in *Strotocrinus* proper, not grouped into five lobes. Its arms also differ in never bifurcating after becoming free. For this group we propose the name *Phyetocrinus* (φῡετος, puffed up; ἀντι, a lily, in allusion to the ventricose vault of the typical species, *Act. ventricosus*, Hall.) ‡

The genus *Strotocrinus*, as here defined, would include the following species, all peculiar to the lower Carboniferous rocks of America:

\*Second vol Illinois Report, p. 188, 1866.

† Some of the species have as many as seventy to eighty arms.

‡ Iowa Geological Report, vol. 1, part Paleont., pl. 11, fig. 6, a b.

## 1.—STROTOCRINUS, M. and W. (proper.)

Section (a). Species without a proboscis.—*S. perumbrosus*,\* *S. regalis* and *S. glyptus*, all described under *Actinocrinus* by Prof. Hall.

Section (b). Species with a proboscis.—*S. agilops*, *S. rudis*, *S. liratus*, *S. umbrosus*,† *S. tenuiradiatus*, *S. tholus* and *S. insculptus*, all described by Prof. Hall under *Actinocrinus*. It may also probably include his *Act. glans*. His *A. clavis* is believed to be synonymous with his *S. agilops* (sp.), and his *Act. subumbrosus* a variety of his *S. liratus* (sp.)

## 2. Subgenus PHYSETOCRINUS, M. and W.

*P. ventricosus*, *P. cancellatus*, *P. ornatus* and *P. reticulatus*, all described by Prof. Hall under *Actinocrinus*; also *P. subventricosus*, described by Professor McChesney under *Actinocrinus*. The proposed species *senarius*, Hall, is believed to be a variety of his *A. ornatus*.

In the single character of having only a simple opening in the vault, without the slightest indications of a proboscis, the *Physetocrinus* group would agree more nearly with the typical section (a) of *Strotocrinus* than the section (b) does, but in all other characters it is more distinct.

## Section (C).

## STROTOCRINUS ECTYPUS, M. and W.

Body depressed, very rapidly expanding to the third radials, above which the secondary and tertiary radials and brachial pieces curve out horizontally. Base about twice and a half as wide as high, truncated, slightly concave, and not expanded or thickened below, but with small nodes around the margin of the under side, placed one at the termination of each of the costæ. First radial pieces wider than high, two heptagonal and three hexagonal. Second radials one-half to two-thirds as large as the first, wider than high, hexagonal, or in part (sometimes) pentagonal, the superior lateral sides being short. Third radials wider than long, pentagonal, hexagonal, or irregularly heptagonal, and supporting on each superior sloping side a secondary radial, each of which gives origin to brachial pieces leading to an arm on the outer side, and supports on its inner sloping side a tertiary radial, which gives origin to two arms, thus making three arms to each main division, or six to each ray, and thirty to the entire series.

First anal piece a little longer than wide, hexagonal, and supporting two pieces of about half its own size in the next range; between the superior sloping inner sides of these there is one small piece, and above these three or four other small pieces, one or two of which extend up so as to separate slightly the outer brachial pieces of the adjacent rays. Interradial pieces four or five to each area, the upper of which is narrow and extends up so as to separate slightly the brachial pieces above. In each interaxillary space there is usually an elongated intercalated piece, sometimes large enough to truncate slightly the upper margin of the third primary radial, while it continues upward so as to separate the brachial pieces above.

Vault much depressed, and composed of numerous, irregular, slightly convex pieces of moderate size, and provided with a rather stout subcentral proboscis, composed near the base of unequal pieces, some of which are distinctly protuberant.

Surface of all the body plates moderately convex, or sometimes a little angular in the centre, and ornamented with distinct radiating costæ, extending from the middle to the sides of each piece, so as to divide the whole into numerous triangles. These costæ are also more or less compound, so as to form a secondary or (below the middle of the first radials) a tertiary series of smaller, less defined triangles within those formed by the principal costæ.

---

\* See vol. ii, Geological Report Illinois, p. 183, 1866.

† Iowa Report, part 11, pl. ii, fig. 3, a b.

Height of body to horizon of arm openings, 0.70 inch, breadth at same, 1.50 inches.

This species resembles in the sculpturing of its body plates *S. glyptus*, Hall (sp.), but has a more depressed body, and is also at once distinguished by having a proboscis, while the *S. glyptus* belongs to the section of the genus with merely a simple opening in the vault. From *S. agilis* it will readily be distinguished by its shorter, more rapidly expanding body and less numerous arms, as well as by its different sculpturing. Although its brachial pieces are a little separated over the anal, interradial, and axillary spaces, there are no distinct sinuses at these points in the margins of the disc, as the little intercalated pieces separating the brachial pieces at these places extend out as far as the latter, so that when the arms are removed the outline of the disc presents only an obscurely subpentagonal outline.

*Locality and position.* Lower division Burlington beds of Lower Carboniferous, at Burlington, Iowa. No. 59 of Mr. Wachsmuth's collection.

*STROTOCRINUS ? ASPERRIMUS*, M. and W.

Body under medium size, urn-shaped, being a little wider at the top of the third radials than high, with the secondary radials and succeeding parts spreading out horizontally, but divided by narrow anal and interradial sinuses quite in to the body, sides ascending with a gradual expansion to the top of the third radials, with a moderately convex outline below the middle. Base about twice and a half as wide as high, not thickened or spreading below, but projecting downward a little around the column, in the form of little nodules, formed by deep notches at the sutures and smaller ones between. First radials generally wider than long. Second radial pieces somewhat smaller than the first, wider than long, some hexagonal and others pentagonal. Third radials a little smaller than the second, generally pentagonal and bearing on each superior sloping side a secondary radial, each of which supports one or more brachial pieces, leading to an arm on its outer sloping side, and a small tertiary radial on its inner, each of which evidently supported two other pieces above, one or both of which were probably brachials. If both sides bore brachials it would make six arms to the ray, but if one side bore an axillary piece it would make eight to the ray or forty in the whole series.

First anal piece of about the same size as the smaller first radials, slightly longer than wide, hexagonal in form, and succeeded by two smaller hexagonal or heptagonal pieces in the second range, above which there seems to be about four other smaller pieces. Subradials three or four to an area, the first one about as large as the second radials, hexagonal or heptagonal in form, and supporting two smaller pieces in the next range, above this there seems to be one, or possibly sometimes two other smaller pieces. Axillary spaces sometimes occupied by one or two small pieces.

Vault much depressed, or rising little above the horizon of the arms, composed of irregular small and moderate sized pieces, and provided with a nearly central proboscis, which in the typical specimen is composed of very small pieces at the base, and a little inclined to one side.

Surface of body plates all prominent and angular in the middle, and provided with well defined, sharp radiating costae, which are compound on the first radial and first anal pieces, but generally consist of a single rib extending from the middle to each of the sides of the others. The mesial prominence on each of the first and second radials is pinched out so as to form a prominent sharp, transversely arranged ridge, while on each of the smaller plates it is a rounded, rather pointed node, the whole presenting a very rough appearance.

Height of body to the horizon of the arms, 0.74 inch. do. to top of vault, 0.88 inch. greatest breadth at the top of third radials, 0.80 inch.

In general form and surface markings this species resembles the following,

[July,

but its body is more spreading above and it has ten or more arms less, while its vault is much more depressed and provided with a proboscis. It seems to bear much the same relations to the section (b) of the genus *Strotocrinus* that the subgenus *Physetocrinus* bears to the typical forms of *Strotocrinus*.

*Locality and position.* Burlington Limestone of the Lower Carboniferous at Quincy, Illinois.

Subgenus PHYSETOCRINUS, M. and W.

STROTOCRINUS (PHYSETOCRINUS?) ASPER, M. and W.

Body somewhat urn-shaped, being obconical below, with nearly straight, gradually expanding sides, and rather ventricose vault. Base about three times as wide as high, truncated below and angular, though not thickened or properly expanded around the lower margin, which is so broadly and deeply notched at the sutures as to present a trilobate appearance as seen from beneath. First radials wider than high, and as usual two heptagonal and three hexagonal. Third radials of the same size as the second, and bearing on each of their superior sloping sides a somewhat smaller secondary radial, each of which bears on its outer sloping side a series of brachial pieces, leading to an arm, while on its inner sloping side it supports a small tertiary radial, bearing on its inner side brachial pieces leading to an arm, and on its outer a small quaternary radial, bearing on its outer side a brachial piece, and on its inner another axillary piece, giving origin to two arms, thus making, as far as can be determined, ten arms to each ray, or fifty to the entire series.

First anal piece as long as the first radials, but narrower, heptagonal in form, and supporting one small piece over its middle and a larger one on each upper sloping side in the second range; in the third range there are three, in the fourth two pieces, and above these, three smaller pieces extending upwards to connect with the vault. First interrarial pieces of about the size of the third radials, hexagonal in form, and bearing two smaller pieces in the second range, above which there are some five or six very small, irregular pieces, some of the upper of which extend up and connect with the vault.

Vault rather ventricose, or more than one-third as high, near the middle, as the body below the horizon of the arms: composed of irregular nearly flat pieces of moderate size; opening apparently simple, at the highest point about one-third of the distance from the middle towards the posterior side.

All the body plates are protuberant and sharply angular in the middle, the angular part, especially on the larger plates, forming a sharp transverse ridge. From the under side of this transverse ridge two or three others extend downward on the first radial and first anal pieces, so as to connect with others on the basal pieces. The second and third radial pieces have each about three small pointed nodes, arranged transversely, while from the third radials narrow ridges extend up to the secondary radials, thence up all the branches to each arm base. All the smaller body plates also have a more or less projecting angular point in the middle.

Notwithstanding the number of arms, the narrow anal and interrarial pieces extend in so as to divide the disc quite in to the body, while even the interbrachial sinuses extend nearly in to the body. The column is of moderate thickness near the base, where it is round and composed of thin pieces with sharp projecting edges, pierced by a nearly round central canal.

Height to horizon of arms, 0.73 inch: breadth across at the interrarial spaces, 0.66 inch: height of vault, 0.46 inch.

This species has its plates sculptured in nearly the same way, and presenting much the same roughened appearance seen in *S. glyptus*, Hall (sp.), but differs materially from that and all of the other species known to us, that resemble it in other respects, in having deep interrarial and anal sinuses in its first, as in the subgenus *Physetocrinus*, with which it also appears to agree in its ventricose vault. It is the only species known to us, however, appa-

rently belonging to that group, that has its body so narrow and produced below, and its body plates presenting the style of angularly sculpturing. If the interradial and anal sinuses of its disc were filled with intercalated pieces it would present nearly all the characters of a typical *Strotocrinus*. Consequently it may be regarded as a connecting link between these groups, and with a few others shows that they cannot be properly separated more than subgenerically.

*Locality and position.* Upper beds Burlington group of Lower Carboniferous, at Burlington, Iowa. No. 67 of Mr. Wachsmuth's collection.

*STROTOCRINUS (PSEUDOCRINUS) DILATATUS, N. and W.*

Body rapidly expanding, with nearly straight sides, from the base to the secondary radials, thence spreading more abruptly to the brachial pieces, which are directed out nearly horizontally, and so closely crowded all around as to come very nearly, or sometimes quite, in contact over the anal and interradial areas. Base about three times as wide as high, not thickened or expanded below, but provided with a large round perforation. First radial pieces comparatively large, generally wider than high, two heptagonal and three hexagonal. Second radials only about half as large as the first, some of them quadrangular, and others with one or both of the upper lateral angles a little truncated, so as to make them properly pentagonal or hexagonal. Third radials larger than the second, wider than long, pentagonal, hexagonal or heptagonal, and supporting on each superior sloping side a secondary radial, each of which gives origin on its outer side to brachial pieces leading to an arm, while on its inner side a tertiary radial gives origin to two arms in all but the two posterior rays, where one or sometimes both bear on one side another axillary piece, making seven or eight arms in each of these rays, or, in the latter cases, thirty-four arms to the entire series.

First anal piece as large as the largest first radial pieces, and bearing above two heptagonal or octagonal pieces of near its own size in the second range, with three smaller pieces in the third range, and two or three minute pieces over these, one of which is wedged in between the brachial pieces above. First interradial pieces generally larger than the second radials, heptagonal or octagonal, and surmounted by two smaller pieces in the second range, over which we usually see one or two small pieces wedged up between the outer brachial pieces of the rays on each side. There is also usually a small interaxillary piece between the secondary radials of each ray, but it seems never large enough to extend down so far as to truncate the upper angle of any of the third primary radials.

*Locality and position.* Lower beds of the Burlington group. Lower Cambrian. No. 58 of Mr. Wachsmuth's collection.

### Genus MEGISTOCRINUS, O. and S., 1891.

The type upon which this genus was founded (*M. Eboracensis*) has a short, broad, cup shaped body, with a depressed vault and a more or less rounded above, and rounded under below to the flat margin. The vault is usually a little impressed, or less prominent than the flat margin. The body plates extending horizontally outward at right angles to the margin of the under side. In some species the base is slightly projecting, but it can rarely be said to project beyond the surrounding body plates. The body plates are moderately thick, and separated by well defined, rather deep sutures, so as to present a more or less convex surface with a transverse or radiating costæ, though there are rarely small elevations at the corners of some of the plates.

The nearly or quite flat vault is composed of triangular, irregular, more or less oval or convex pieces, of moderate size, the middle ones sometimes being a prominent, rather pointed node, that may be in some cases even developed into a short spine. The opening is decidedly lateral, often penetrating to the basal side below the horizon of the arm bases; sometimes it is in the same plane as the arm openings, or rarely slightly above them. It is never enclosed in a thickened protuberance, however, as in *Trilobocrinus* and *Agaricocrinus*, but always shows thin, broken, abruptly projecting edges, as if they were to be produced into a short, slender tube, or so-called proboscis, projecting horizontally backward.

In the number and arrangement of the pieces composing the wall of the body, up to the third radial pieces inclusive, this genus presents no essential differences from *Actinocrinus*, with which it also agrees in having the pieces more or less grouped, or separated by interradial and subradial lines, never forming a continuous series all around, as in *Bellerophon* and *Strotocrinus*. It not only differs from *Actinocrinus* in its general physiognomy and the nature and position of the opening, but also in having its arms each composed of a double series of bifurcations, as in *Amphicrinus*, though it differs widely in other respects. This peculiarity of having the arms composed of a double series of alternating pieces, forming at the base a double bifurcation, is not only continued down to the base, but in some species extends to the base of the rays included as a part of the wall of the body, and sometimes to the nearly one-fourth of the way down the side, to within the lower part of the third primary radials.

The six or seven known true typical species of this genus form a group so distinct that they can be readily distinguished at a glance from the other genera, such as *Amphicrinus*, *Agaricocrinus*, *Doverocrinus*, *Cylindrocrinus*, *Saccocrinus*, &c. There is, however, at least one, and probably two, known *Cylindrocrinus* species standing as it were between *Megistocrinus* and *Saccocrinus*, and combining characters of both to such an extent that one of them (*M. Halli*) was referred by Prof. Hall to *Megistocrinus*, while the other was placed as a section or subgenus of *Actinocrinus*, while the name of the latter was given by us, *Actinocrinus (Saccocrinus ?) amplius*, to designate the more robust form.

\* See second Report, Wisconsin, Iowa and Minnesota, pl. V. A. fig. 2.

It is not to be believed that those remarkable truncated forms, with very small, or even no, arms, and an erect subcentral proboscis, such as *M. typicus* of Dr. Schuchert, pl. iv. fig. 7, really belong to *Megistocrinus*.

It is to be remembered, as already intimated, that this may not be distinct from *M. Halli*, but as it is larger and more robust, however, and has a more distinct proboscis, and the ridge seen extending up the radial series of the body plates, and other details, and came from the upper part of the Burlington group, while scarcely any species of Crinoids are believed to have lived in the lower part of the lower Cambrian.

vinced that it is not a true *Artinocrinus*, and believed it related to *Saccocrinus*. From direct comparisons with Prof. Hall's typical specimens of the species *M. Whitei*, in the Museum of the University of Michigan, Professors Winchell and Murey were also led to refer Shurinn species of *Saccocrinus* to *Megistocrinus*.

The Silurian typical forms of *Saccocrinus* have the same arm structure, as well as essentially the same arrangement of body plates, as *Megistocrinus*, but differ in having a much more elongate narrow body, composed of thin even plates without excavated sutures, and a protuberant oscon, instead of a flat or impressed base, also a subcentral opening, or 'protostoma' instead of a decidedly lateral proboscidean opening in the vault, thus presenting a decidedly different general physiognomy from the typical Carboniferous forms of *Megistocrinus*. If we had only the typical forms of these two groups to deal with, there would be no difficulty in separating them. The two species or varieties, *Whitei* and *amplus*, however, are not so easily disposed of since they have the same thin smooth plates, without impressed sutures, seen in *Saccocrinus*, and nearly as protuberant a base, while their body is exactly intermediate in form\* and their arm structure the same as in both of these groups, with which they also equally agree in the number and arrangement of the body plates. We have never seen a specimen of any of the Silurian species of *Saccocrinus* showing the vault, but all the casts we have examined seem to show that it was nearly flat and had either a subcentral opening or protostoma and no traces of a decidedly lateral opening as in typical forms of *Megistocrinus*. A specimen figured by Dr. Roemer in his work on the Silurian fossils of Tennessee, shows the vault to be protuberant in the middle and provided with an opening there, with some appearance of being surrounded by the remains of the base of a proboscis though it may possibly be only a simple opening in a prominence. In the Carboniferous species *Whitei*, as already stated, there is a small subcentral opening in the depressed vault, without any traces of a proboscis and we can now scarcely doubt that this is the case with the *amplus*, and the vault of both these species also differs from that of the typical *Megistocrinus* in being composed of innumerable minute pieces.

Although there are a few points in regard to the relations between these groups that we have not yet been able entirely to clear up, we are, from all the facts now known to us, inclined to believe that *Saccocrinus* should be ranged as a subgenus under *Megistocrinus*. At any rate, if the species *Whitei* and *amplus* are to be included under *Megistocrinus* at all, we think they should certainly be at least placed on a separate subgenus from the typical forms, and until these questions can be more definitely settled from the study of more extensive collections we prefer to retain for this subgenus the name *Saccocrinus*. With these limits the genus *Megistocrinus* would include the following American Carboniferous forms:

1. *Megistocrinus*, Owen and Shumard, 1850.

Body short, broad and composed of rather thick convex pieces, base flat,

to these two horizons, we are not entirely convinced that they are identical. All the specimens of the species *Whitei* and *amplus* we have seen are in a more or less crystalline condition which in some instances caused the vault to protrude in such a way as to form a decided lateral opening with a central or subcentral protostoma, especially as several of the specimens clearly show that certainly as the traces of a lateral opening anywhere near the anal side is not typical of *Megistocrinus*. Mr. Winchell informs us, however, that he has recently found a specimen of the species *Whitei* showing that it has a small subcentral opening, in which a *Strotocrinus* section cut, and from this we infer that one of our *amplus* to that species, it is highly probable that it also has a subcentral opening, without a proboscis.

\* It is proper that we should also state here that there are considerable differences of form among the Silurian species of *Saccocrinus*. For instance we have now before us from the Niagara beds of Ontario a set of natural casts having all the characters of variety of a higher type than any of this group that are as short in form as even the typical *Whitei* and *amplus* forms of *Megistocrinus*, while specimens of *Saccocrinus Christi* Hall now before us from the Niagara beds of Western Indiana have the body presenting a most exact form of the typical specimens of the Carboniferous species *Whitei*, with which, through the politeness of Prof. Winchell, we have been able to compare them.

[July,

*A. oratus*, *A. securus*, *A. opusculus*, *A. excerptus*, *A. infrequens*, *A. thalia*, *A. thetis*, *A. thoas*, *A. locellus*, *A. sexarmatus*, *A. reticulatus*, all described under *Actinocrinus* by Prof. Hall. Also, *A. Fosteri* and *A. Hurdianus*, McChesney, and our *A. longus* of this paper.

It is worthy of note that all the known Burlington species of this group came from the Lower Burlington beds, as has been determined by Mr. Wachsmuth, by careful observations continued through many years.

#### ACTINOCRINITES. Section (a).

##### ACTINOCRINITES PENICILLUS, M. & W.

Body small, inversely campanulate, or with sides expanding rapidly from the truncated base to the secondary radius, which with the brachial pieces curve a little outward. Base much depressed, or about four times as wide as high, broadly truncated and but slightly concave below; margin more or less expanded horizontally, and deeply notched at the sutures. First radial plates comparatively rather large, and about twice as wide as high. Second radials near half as large as the first, about twice as wide as high. Third radials a little larger than the second, wider than long, and pentagonal in form, the lateral margins being short, each supporting on each of its superior sloping sides a secondary radial of about its own size, which in its turn supports two free arms.

Anal pieces unknown above the second range; first one smaller (particularly narrower) than the first radials, and supporting two others of its own size in the next range. Interradial pieces three to five in each space; first one as large as the second radials, hexagonal in form, and bearing upon its upper sloping sides two smaller pieces, above which there is generally one or two minute pieces.

Arms free from their origin on the secondary radials, and composed below of slender rounded pieces, the first of which is about twice as long as wide, and more or less constricted in the middle; beyond this the lateral arm on each side of each ray is simple, with its second piece like the first, and followed by two or three other shorter wedge formed pieces before passing into a double series of small, alternately arranged pieces. Inner arms of each ray bifurcating on the first piece, and one of the subdivisions in one or both bifurcating again on the first piece, thus making from seven to eight arms to each ray, or from thirty-five to forty in the entire series. The single piece below and the first above each division, is slender, rounded, and more or less constricted, and generally two or three wedge formed pieces follow the latter before the commencement of the double series of alternating pieces, above which the arms are a little wider and of moderate length. Vault unknown; proboscis very slender at the upper end, and apparently of about the same length as the arms.

Surface of all the body plates deeply excavated at the corners, and prominent in the middle, the prominence of the first radials usually forming a transverse ridge, from which a single more or less defined vertical ridge ascends the second radials to the middle of the third, from which it bifurcates and continues to the secondary radials.

Height of body to the top of secondary radials, about 0.22 inch; breadth at the top of secondary radials, 0.40 inch; length of arms if straightened out, about 0.70 inch; breadth of do. at the widest part near the middle, 0.05 inch.

This little species is allied to *A. lucina*, Hall, which, before seeing specimens showing the arms, we had supposed to belong to the *A. multibrachiatus* group, but which is a true *Actinocrinites*. Our species differs, however, in having the arms more frequently and differently bifurcating, so as to make from thirteen to fifteen more in the entire series. Its arms also differ in not being subspinous on their margins.

1869.]

This species is apparently most nearly allied to *M. brevicornis*, Hall (sp.), but differs in having a greater number of ranges of brachial pieces included as a part of the walls of the body, and these pieces wider and commencing as double series farther down. Its opening is also placed decidedly lower even than the proposed species *Act. minor*, of Hall, being distinctly below the horizon of the lower edge of the arm openings, and nearly halfway down the side, measuring from the highest part of the vault. Its larger vault pieces, excepting the middle ones, are also more prominent and pointed. Its body and vault plates are all much more convex, its arm bases stouter, its vault less depressed, and its opening decidedly lower than in *M. superlatus*, Hall (sp.).

*Locality and position.* Upper Burlington beds of the Lower Carboniferous at Burlington, Iowa. No. 161 of Mr. Wachsmuth's collection.

#### Genus DORYCRINUS, Roemer.

##### DORYCRINUS CANALICULATUS, M. and W.

Body under medium size, cup-shaped below the arms, rather rapidly expanding from the lower margins of the first radials to the arm bases. Base extremely short, its entire height merely consisting of the thickness of the plates, subhexagonal in outline, with small lateral notches at the sutures, scarcely projecting below the first radial and first anal piece; facet for the attachment of the column occupying about half the breadth of the base, round and rather deeply impressed. First radial plates about once and a half as wide as high, all very nearly hexagonal, there being scarcely any perceptible angle at the middle of those over the sutures of the base. Second radials scarcely half as large as the first, about once and a half as wide as long, and presenting the usual quadrangular outline. Third radials a little wider and shorter than the second, pentagonal in form, and bearing on their upper sloping sides, in the posterior rays, two slightly smaller secondary radials, each of which supports two brachial pieces, thus giving origin to four arm openings to each of these two rays; while in the anterior ray one side of the third radial merely bears a series of brachial pieces leading to an arm, and its other side a tertiary radial, supporting two brachial pieces, thus making three arms to this ray. In both anterior lateral rays each third radial bears on each side two brachial pieces in direct succession, making only two arm openings to each of these rays, or fifteen to the entire series.\*

Anal pieces about eight, below the horizon of the arm openings; first one as wide as the first radials, and a little longer, heptagonal in form, and bearing three smaller pieces in the second range, above which there are five smaller pieces in the third range, connecting with others extending up to the opening

ACTINOCRINITES. *Section (b).*

## ACTINOCRINITES LONGUS, M. and W.

Body rather elongate-obconic below the arms, the sides expanding gradually, with a moderately convex outline from the base to the tertiary radial pieces, which, with the brachial pieces, curve very slightly outward. Base about twice and a half as wide as high, not thickened or expanded below, and but very slightly notched at the sutures; facet for the reception of the column large and moderately concave, with a rather large central perforation. First radials comparatively large, very nearly or quite as long as wide. Second radials scarcely half as large as the first, about as wide as long, quadrangular, pentagonal or unequally six-sided. Third radials of about the same size as the second, pentagonal, hexagonal, or heptagonal, and each bearing on its superior sloping sides two secondary radials of near its own size, each of which supports, on its outer sloping upper side, brachial pieces, leading to an arm, and on its inner side, above, a small tertiary radial giving origin to two arms, thus making three arms to each main division, and six to each ray, or thirty to the entire series. (Arms unknown.)

Anal plates five or six, the first being of the same size as the smaller first radials, hexagonal in form, and a little longer than wide; second anals two, about two-thirds as large as the first, and irregularly heptagonal or octagonal; above these there are two smaller pieces in the third range, and one or two still smaller pieces above the latter, the upper one being barely large enough to separate the posterior lateral brachial pieces of the two posterior rays. First interrarial pieces about half as large as the first radials, heptagonal, and supporting two smaller pieces in the second range, above which there are one or two still smaller pieces in the third, and a minute piece over the latter, wedged in between the brachial pieces. In each interaxillary space there are usually two intercalated pieces, the lower of which is sometimes as large as one of the tertiary radials, while the upper is very small, and wedged in between the brachial pieces.

Vault conical, and nearly three-fourths as high as the body below the arms; composed of irregular pieces of moderate size, some of which project in the form of small pointed nodes or short spines, passing gradually into a rather large subcentral proboscis.

Surface of all the body plates rather distinctly convex, but not properly tumid, and showing but the faintest traces of an effort to form, on some of the smaller pieces, an obscure radiating ridge near each side. In most cases, however, these are entirely obsolete, and the plate seems to be merely evenly convex.

Height of body to arm bases, 1.20 inch; breadth of do. at arm bases, 1.40 inch; height of vault, about 0.80 inch.

In the structure of its body, as well as in its arm formula, this species agrees with *Actinocrinus clavus*, of Hall. It differs, however, greatly in form, as well as in the surface characters of its body plates, being rather elongate obconical below the arms, instead of "very broadly subturbinate, and spreading more rapidly above the third radial plates;" while its body plates are merely convex, instead of being "elevated into strong angular nodes, some sometimes marked by low ridges on the lower part," and by "strong angular ridges" on the upper part.

Its elevated conical vault, passing gradually into the nearly central proboscis, and narrow obconic body below the arms, give it a peculiar fusiform outline. In the nature of its vault it resembles quite nearly *A. costatus* of Hall, from which, however, it differs widely in other respects.

*Locality and position.*—Lower beds Burlington group of Lower Carboniferous, Burlington, Iowa. Mr. Wachsmuth's collection.

1869.]

Surface of all the plates, including those of the vault, regularly granular. Column of moderate size, round, and composed near the base of alternately thicker and thinner pieces, with radiately striated surfaces, and perforated by a very small nearly rounded central canal.

Height of body to top of vault, 0.88 inch; breadth, including three brachial pieces on each side, 1.13 inches; breadth of concavity of under side, 0.57 inch; thickness of column 0.40 inch from base, 0.17 inch.

This species differs from all the others yet known from the Burlington group, in having three arms to each posterior ray. It is most nearly allied to *A. latatus*, Hall, a single individual of which, out of a considerable number in Mr. Wachsmuth's collection, has abnormally three arms in *one* of the posterior rays all the others having two to each ray all around. It differs also from all of these, however, as well as from the original type now before us, in having the concavity of the under side less deep, and all the pieces surrounding it more tumid, while the form and proportions of its body pieces are different, its anal region much more protuberant, and its vault pieces less rounded and swelled. Its surface is also more coarsely granular.

*Locality and position.* Highest part of the upper bed of the Burlington group at Burlington, Iowa. Lower Carboniferous. No. 146 of Mr. Wachsmuth's collection.

#### Genus PLATYCRINITES, Miller.

##### PLATYCRINITES TENUIBRACHIATUS, M. and W.

Body rather small, subglobose, being somewhat wider than high. Base shallow, or dish shaped, with a subpentagonal outline and a rather broad shallow concavity below, nearly twice as wide as the rather small round facet for the attachment of the column. First radial pieces a little wider than high, having a general quadrangular form, but with the superior lateral angles slightly truncated for the reception of the interradial pieces, and the lower sides a little convex in outline; sinus in the upper side of each equaling about half its breadth, and extending down on the outer side about one-third to one-fourth its length. Sutures channeled by the beveling of the edges of the plates. Second radial pieces very small, wider than long triangular in form, and wedging out on each side so as to allow the first brachial pieces to come in contact with the first radials at the lateral edges of the sinuses in the same.

First divisions of the rays, from their origin on the second radial pieces, each round and composed of a single series of somewhat wedge shaped pieces to the fourth piece, which has a pentagonal outline and gives origin to two divisions, the inner one of which is smaller than the other and without farther

This species is related to *Platycrinus Americanus*, of Owen and Shumard, with which it agrees in the size and form of its body. Its surface sculpturing, however, is somewhat different, that species having merely a nodular ridge running along the lower and lateral margins of the first radial plates, and two others starting from the lower lateral angles and converging to the sinuses in the middle of the upper edge, with little isolated nodes on the intermediate spaces; while in the species under consideration there are merely three somewhat nodular ridges, parallel to the basal and lateral margins of these plates, with more or less granules in the central region. As such markings, however, are subject to some variation in individuals of the same species of this group, we should not have regarded the differences mentioned of sufficient importance to warrant the establishment of another species, if it were not for the additional fact that Mr. Wachsmuth finds specimens agreeing exactly with Owen and Shumard's species in the ornamentation of the body, and yet having only six arms to each ray, or thirty in the entire series, instead of eight to each ray, as in that under consideration.

*P. Wortheni*, Hall, agrees with this in having eight arms to the ray, but they are much stouter, and differ in being roughened by numerous small asperities, while its second radial pieces are much smaller, and each supports on each side above only two very short pieces between it and the first bifurcations above, instead of four. Similar differences are also seen in the details of the other divisions, while the surface ornamentation of the two species is entirely different, and the base of the *Wortheni* is flat or broadly concave, instead of being moderately convex with merely a central concavity.

*Locality and position.* Upper beds of Burlington Limestone, Burlington, Iowa. No. 218 of Mr. Wachsmuth's collection.

#### Genus PROTASTER, Forbes.

##### PROTASTER? GREGARIUS, M. and W.

The disc of this species is circular in outline, slightly convex above, and measures from 0.20 to 0.30 inch in diameter. In most cases it looks as if merely covered by a smooth membranaceous integument. Some casts of its external surface, however, seem to show traces of flat, nearly smooth, imbricating scales above. The five arms are slender, flexible, and rather long in proportion to breadth. In a specimen with a disc measuring 0.25 inch in breadth, the diameter of the arms near the disc is only 0.05 inch. None of the specimens show the entire length of the arms, though some fragments of them were seen lying detached in the matrix, about 0.55 inch in length, without being complete at either end. From the breadth and gradual taper of these it would seem probable that when entire they may have been 0.75 to 1 inch in length. Their impressions in the matrix give no indications of a longitudinal furrow along the under side, but show that there were about six pairs of arm pieces in a length of 0.16 inch. These pieces appear to be nearly though not exactly opposite, and each one provided below with a comparatively large, round, deep pit or pore, near the middle of its anterior side. Along their lateral margins there appear to be impressions in the matrix of very small spines (one to each arm piece), though if such they must have been extremely short. Impressions of the upper side of the slender arms show them to have been somewhat rounded above, with the nearly square arm pieces slightly alternating. Some of the impressions seem to show traces of central pores or pits, one at the middle of each pair of pieces, though in others no traces of these are visible.

We have numerous specimens of this little species before us, but as they are all merely in the condition of casts and moulds in a very fine, somewhat granular matrix, they do not show the details of its structure very clearly. As far as its structure can be made out, however, it seems to agree well with the general features of the genus *Protaster*, as illustrated by Prof. Hall in the Twentieth Report of the Regents of the University of N. Y. on the State Cabi-

net of Nat. Hist., though not with Mr. Salter's figures of *P. Miltoni*. It will probably be found to be generically distinct from the Silurian typical forms of *Protaster*, but we prefer to place it provisionally in that genus for the present. We are not aware that any well defined species of the genus *Protaster*, however, have been found in Carboniferous rocks.

*Locality and position* Crawfordsville, Indiana. Keokuk division of the Lower Carboniferous series.

## MOLLUSCA.

### Genus CHÆNOCARDIA, M. and W.

(*χάλω* to gape; *καρδια*, the heart; in allusion to its gaping front and general form).

Shell equivalve? rather thin, very inequilateral, more or less oval, beaks small, depressed and nearly terminal, valves strongly gaping in front, and closed behind, hinge unknown, but short and without cardinal area, surface with concentric striae, crossed on the posterior dorsal region by faintly marked radiating costae, and on the gaping front by radiating lines and costae.

Although we have not seen the hinge of this type and know very little of its muscular\* and palhal impressions it differs so decidedly in its external characters from all the established genera known to us that we cannot doubt the propriety of proposing a new genus for its reception. In the single character of having the valves distinctly gaping anteriorly, it resembles the Silurian genus *Hippomya* of Salter, to which it may bear some relations. It differs, however, in having the gaping part of the valves terminal instead of occupying the anterior ventral region. When placed with the hinge line in a horizontal position, the margins of the gaping part, which are not thickened and reflected as in Mr. Salter's genus, are found to slope slightly forward as if truncated in that direction from immediately in front of the beaks instead of sloping posteriorly to the middle of the basal margin. Our type also differs in the possession of radiating markings, and much smaller umbones, as well as in being less gibbous. It is true that some of these characters might be merely specific, but we cannot believe they all are, while the general physiognomy of the two forms is so different as strongly to impress the mind with the idea of their belonging to entirely distinct genera.

Without a knowledge of its hinge and interior, it is not possible to arrive at very satisfactory conclusions in regard to the family relations of this shell, though we are inclined to believe it related to the *Mytilidae*. The gape of the front was doubtless for the passage of a byssus, as it is too high up from the antero-ventral margin to have been for the protrusion of a foot to be used in crawling about.

The description is made out from left valves only.

### CHÆNOCARDIA OVATA, M. and W.

Shell obliquely ovate, more than two-thirds as wide as long, moderately gibbous, the greatest convexity being a little in front of the middle. Posterior outline rounding into the cardinal margin above, and into the base with a broad subsemicircular curve, deepest part of the base behind the middle from near which the anterior ventral margin ascends very abruptly and a little obliquely forward, with a slightly convex outline, to the lower part of the anterior hiatus. Anterior gaping edge truncated, with a slightly convex outline and forward slope from immediately in front of the beaks, and defined, or separated from the body of the shell by a faint sulcus starting from the immediate front of the beak, and curving downward so as to intersect the margin at the base of the hiatus, which (supposing it to be equally developed in the

\* One internal cast appears to show trace of a long narrow, anterior adductor muscular scar near the edge of the gaping part of the valve.

right valve) is about twice as long as wide, and of a broad lance-ovate form, most angular at the base. Hinge line scarcely more than one-fourth the greatest length of the shell, measuring obliquely from the anterior extremity to the posterior basal margin, and ranging at an angle of about  $45^{\circ}$  to the longer axis of the valves. Beaks very small, incurved, and depressed almost to the cardinal margin; located nearly over the anterior edge. Surface with concentric striæ obscure; radiating costæ of the posterior dorsal region very faintly marked, and broader than the slight furrows between, while very obscure traces of fine longitudinal striæ may be seen on some of them; radiating costæ of the anterior, fine, and rather sharply defined on the gaping edge, back of which a few larger obscure ribs may be seen, the posterior one of which is larger than the others, and curves down from the anterior side of the beak so as to intersect the margin of the valve a little below the lower end of the hiatus.

Length, 2 inches; height, measuring at right angles to the greatest length, 1.4 inch; convexity of the left valve, 0.50 inch; length of anterior hiatus, 0.53 inch; breadth of do. in same, 0.16 inch.

This shell differs so widely from all others known to us from our Carboniferous rocks, that a comparison is unnecessary. Indeed we know of no other form liable to be confounded with it, from rocks of any age.

*Locality and position.*—West Pecan Creek, Grundy County, from the lower part of the Coal Measures.

### Genus ALLORISMA, King.

#### ALLORISMA COSTATA, M. and W.

Shell under medium size, longitudinally oblong, the length being more than twice the height, very thin, rather convex in the central and umbonal regions; anterior margin rather short, closed and narrowly rounded; basal margin forming a long nearly semi-elliptic curve, with a very slight sinuosity in front of the middle; posterior side compressed; but apparently a little gaping and distinctly truncated, nearly vertically, from the base about half way up, and thence a little obliquely forward and upward to the dorsal margin; posterior dorsal region compressed above the umbonal ridge; cardinal margin equaling about two-thirds the entire length of the shell, very nearly straight, and inflected so as to form a narrow or lance-linear corselet, extending its whole length; beaks convex, rising a little above the cardinal margin, and placed slightly more than one-sixth the length of the valves behind the anterior extremity; valve well defined and lance-ovate in form. Surface ornamented by about twenty-five very regularly arranged, distinctly elevated concentric costæ, which commence near the lunule, and extend backward parallel to the base, to the well defined, angular umbonal ridge, leading from the beaks to the posterior basal extremity, at which ridge they become suddenly obsolete, or very nearly so, being mainly represented on the more compress posterior dorsal region by distinct lines of growth, which are crossed on the middle of this area by a second oblique linear ridge extending from the beaks to the middle of the posterior margin. Some indications of the usual minute surface granulation appear to be visible in some of the moulds left in the matrix.

Length, about 1.20 inch; height, 0.53 inch; convexity, 0.44 inch.

This is a very neat, elegant species, of the type *A. elegans*, King, and *A. Girtyi*, Meek, (= *K. elegans*, Geinitz,\* not King). It is a more slender species, however, with much more sharply elevated, and more regularly disposed costæ than the former; while it will also be readily distinguished from the latter by its costæ, and much more depressed umbones, wider (higher) posterior extremity, &c. The regularity and prominence of its concentric costæ, and their very abrupt termination along the umbonal ridge or carina, are remarkable

\* Carbon f. und Dyas in Nebraska.

characters that give the posterior half of the valves much the appearance of some types of *Trigonia*.

*Locality and position.*—Found by Mr. Green, of the Illinois Survey, in Warren County, Illinois, in a black lustrous limestone near the base of the Coal-measure, associated with *Lima retifera*, and *Cardiomorpha Missouriensis* Shumard, *Anculopecten* ? *carbonarius*, Stevens, sp., *Pecten Broadheadi*, Swallow, *P. Hawni*, Gein.), *Spiriferina Kentuckensis*, Shumard, *Chonetes mesoloba*, N. & P., *Schizodus curtus* M & W, and various other species, many of which have been generally, until recently supposed to be mainly confined to the upper part of the Coal-measures\*. Mr. Broadhead also found it associated with many of the same fossils near the upper part of the Coal-measures in Fayette county, Illinois.

---

August 3d.

The President, DR. HAYS, in the Chair.

Twelve members present.

---

August 10th.

The President, DR. HAYS, in the Chair.

Eighteen members present.

---

August 17th.

The President, DR. HAYS, in the Chair.

Sixteen members present.

On motion, it was resolved, that the Academy take part in the Centennial Anniversary of Humboldt's Birthday, to be held on the 13th and 14th of September. Dr. H. C. Wood, Jr., was appointed by the Academy as orator, to deliver an address on the occasion.

The following paper was offered for publication: "On *Brevortia*," by Alphonzo Wood.

---

August 31st.

DR. MAYBERRY, in the Chair.

Eighteen members present.

---

\* I have also been interested to see amongst the Illinois State Collections from the shale associated with the coal-bed at Danville in that State a new type of bivalve I had never before seen from any other locality than Nebraska City, Nebraska, where it occurs in the Upper Coal-measure beds referred by Prof. Mason to the horizon of the Permian. It is a small, smooth, compressed, elongated equivalve bivalve with nearly parallel straight upper and lower margins and a distinct rather large rectangular notch in the anterior ventral margin, forming a lunus similar to that seen in the genus *Acylophaga* though it evidently has no relations to that group but seems to be allied to the *Solenida*. In Dr. Hayden's report on the Geology of Nebraska, I have proposed for this genus the name *Prochyrus*.

From the same bed at Danville, Ill., I have likewise seen in the State Collection specimens of Prof. Girty's Nebraska species *Gerrillia longa*, one of which shows the hinge to have none of the characters of *Gerrillia* or *Bakerella*, since it has no trace of the row of cartilage pits characterizing those genera. On the contrary, it seems to agree well in its hinge characters with the genus *Acicula*.

F B MEX.

[August,

The following gentlemen were elected members :

Dr. John C. Spear, U. S. N.; Jas. Lanman Harmar; Dr. Fausto E. Rendon.

The following were elected Correspondents :

Prof. A. Kolliker, of Wurzburg, and N. H. Bishop.

The Committee to which was referred the paper by Alphonzo Wood, entitled "On Brevoortia," reported in favor of its publication in the Journal.

On favorable report of the Committee, the following papers were ordered to be published :

#### **The Auroral Display of April 15, 1869.**

BY J. ENNIS.

This auroral display was the brightest that has appeared at Philadelphia since the memorable one on the evening of August 28, 1859. On both these occasions the light was most beautiful and striking, and during the interval between the two no display occurred at all to be compared to these in brightness, in beauty, in variety of coloring, and in general grandeur and magnificence of view. They both began just as the twilight was dying away. The former slightly exceeded in gorgeous coloring, and the latter in duration, for it continued to be still strikingly grand until after midnight. On both occasions the chief colors were pale rose and pale green, but though pale in tint they were very bright, clear and impressive.

The cause of the aurora borealis is generally admitted to be the passage of electricity from the northern region of the globe toward the south. This passage I suppose to be CONSTANT, and in THREE DIFFERENT PATHS: the lower, through the surface of the earth; the middle, along the top of the atmosphere; and the higher, along what are called the magnetic curves; the earth being considered as a great magnet, with the poles north and south.

The lower path becomes evident by studying the disturbances of the magnetic needle. Mr. Charles V. Walker came to the conclusion, from magnetic irregularities, that over the south-eastern portion of the New England States there is a stream of electricity of indefinite width drifting across the country, moving to and fro in a line from N. 42 E. to S. 42 W.\* Professor Loomis, of Yale College, in discussing the great auroral display of 1859, says he found similar magnetic disturbances over the continent of Europe, and that they are propagated in a direction from N. 28 E. to S. 28 W. He intimates that perhaps more observations would show the directions in Europe and America to be the same.† Probably the electric currents on both continents would be found flowing more nearly north and south. All the facts of these magnetic disturbances coincide with the idea that the electric stream is through the earth's surface, the actual position of the magnets irregularly deflected.

The necessity for such a current through the earth's surface southwardly becomes evident from the fact that the solid portion of the globe is constantly robbing the atmosphere of its electricity. We behold the tendency of this fluid to come down in a thunder shower; and sometimes, though rarely, the thunder and lightning will fall from a cloud without any rain. I know an instance, witnessed by several credible persons in the north-eastern part of New Jersey, where a lightning stroke, with a loud report, and without any rain, fell from a small summer cloud and struck one of the cattle in the field, which had a bell at its neck. The solder of the bell was partly melted, and the animal was killed. In all ordinary good weather, the higher we ascend in the air the more strongly do we find it charged with electricity. The under

\* Amer. Journ. Sci. and Arts, vol. 32, p. 326.

† Ibid, p. 334.

side of any stratum, say two hundred feet thick, is always negative to the upper side; and at the same time it is positive to the upper side of a stratum directly below. The lower side of this lower stratum is positive to the solid earth below, which is negative to the air above. From this condition in the air, and the relative condition between the air and the ground, there must be a constant passage of electricity more or less from the atmosphere to the earth. As the extra accumulation is at the north, it must go south through the earth for the equilibrium. This extra accumulation in the north is proved by the visible aurora borealis.

The second path southward of the superabundant electricity at the north is along the top, or through the exceedingly rare upper regions of the atmosphere. The auroral arch has in some cases been found to be about forty miles above the earth's surface. We may say it is at or near the top of the atmosphere possessing an appreciable density. This arch always moves towards the south. While it moves it seems to part with portions of itself in the form of "streamers,"—far extending lines upward,—in the directions of the magnetic curves. The "streamers" cease to be visible before they reach low southern latitudes, and so does the arch; but the want of visibility, either in the streamers or in the arch, is no reason why the electric fluid does not continue to flow in both cases towards the equator. Streamers cannot be supposed to rise from the arch in the lower latitudes, because there the magnetic curves coincide so nearly with the horizon; and the parting of the streamers may perhaps cause the visibility of the arch.

Nearly twenty years ago I had a very distinct view of the electric fluid flashing along the top of the atmosphere. It consisted of sheets of flame, thin and broken, darting from north to south. I was standing on the back platform of the last car of a train travelling from New York to Newark, N. J., where I then resided. The sky was perfectly clear, and I think, though I am not certain, it was bright moonlight. I remember very distinctly that no aurora borealis was seen,—at least such as the aurora generally appears. But in looking towards the east I saw at intervals bright patches of flame shooting from north to south. These fiery patches were not the mild faint glow of the ordinary aurora, but bright like flame, though very much broken and ragged, evidently very thin, and about eight or ten degrees in diameter. Their course before disappearance ran through an arc a little longer. It was as though something was passing rapidly through the atmosphere along its top, and by friction was grating fire now and then as it passed. A few others saw the display, and I believed then, as I believe now, that I saw the frictional effect of the electric fluid against the atmosphere while flowing from the polar to-

conviction that I actually saw electricity, whatever that may be, transferred bodily from north to south. But did these mild but swift electric clouds take the path along the top of the atmosphere, or along the magnetic curves? They were certainly quite distinct from the tall continuous streamers. I incline to believe that they ran along the top of the atmosphere, and that they were nearer than the streamers. But by mere vision the relative nearness of such objects cannot well be distinguished; we cannot tell the relative nearness of a planet and a fixed star by simple inspection, although the one may be several hundred thousand times farther off than the other.

In Prof. Loomis's description of the great auroral display of Aug. 28, 1859, he records some very remarkable observations, and reproduces the diagrams showing the deflected course pursued by some streams and flashes of electricity.\* Such tortuous streams would be impossible in the magnetic curves. But they are what should be occasionally looked for when the electric fluid passes through and over the upper regions of the atmosphere. That atmosphere we know is composed of various strata and various currents, some dry and some moist, some moving one way and some another, and some charged with electricity more than others. Therefore a stream of electricity floating through or over the rare upper regions of the atmosphere, and meeting these various strata and currents, must be affected differently, and sometimes made to produce just such curved phenomena as are presented in those descriptions.

Lightning down the side of a tree takes a tortuous path from the grain of the wood, or even of the bark.

The upper path, the magnetic curves far away above the atmosphere, pursued by the electric fluid in passing from the north to the south, I do not now discuss. Like many other kindred auroral topics, it is not within the scope of this short paper. That path has been ably treated by B. V. Merish, Esq., of this city, and by Prof. Loomis of Yale College, when describing the great auroral display of 1859 in the *American Journal of Science and Arts*, where both those gentlemen have given references to other authors.

The constant passage of the electric fluid from north to south is indicated by the frequent irregular deflections of the magnetic needle, and by the frequent auroral displays in high northern latitudes. Prof. Loomis portrays a zone around the northern region of the globe, where the aurora is seen eighty times in a year, as the highest maximum average. But this number seems to me to be too small. Many observers speak of their appearance almost nightly. In latitude 70° N., at Bossekop, in Alten Bay, on the coast of West Finmark, M. Lottin observed one hundred and forty-three auroras during an interval of two hundred and six days, between September, 1838, and April, 1839. During the long night of seventy times twenty-four hours, from Nov. 17 to Jan. 25, the aurora was visible sixty-four times. On other occasions within that same period, when the sight of the aurora was impossible on account of thick clouds, it was proved to exist by disturbances of the magnetic needle. At Fort York, in 1780, Umfreville says "there were very few nights without an aurora." Chapell in 1814, when giving his experience, says "the nights were constantly illumined by the aurora." Henderson says he saw the auroras in Iceland in 1814-15 almost every clear night. Such is the testimony of others, but in this short paper I cannot quote. In Prof. Loomis's collections about the great display in 1859, several similar expressions may be found, and also in the collection of Mr. Peter Force in the 8th volume of the *Smithsonian Contributions*. During the summer of 1868 I spent six weeks on the Saguenay river or its near vicinity in Canada, being part of the time at Grand Bay and Chicoutimi, more than a hundred miles due north of Quebec. There the aurora appeared almost every evening; indeed, its appearance was the rule and its absence the exception. But the displays were not strikingly grand. I remarked that on the Saguenay they were much more frequent than when I

---

\* *Am. Journal of Science and Arts*, vol. 31, pp. 84, 85.

was at Montreal, either the same summer or in that of 1858, when I spent more than a month in or near that city. That difference of latitude, about three degrees, made what appeared to me a disproportionate difference in the frequency of auroral displays,—a difference, however, not as great as that between Montreal and Philadelphia, which is again a difference of latitude about five and a half degrees.

In high northern latitudes the auroral phenomena are rendered invisible a very large part of the year by twilight. At Montreal the twilight lasts until 10 o'clock and begins at 2, and on the Saguenay it ends at 11 o'clock and begins at 1. In latitude near  $60^{\circ}$  N. many years ago, in the month of June, I could read very easily at midnight by the light of the sun, which luminary seemed, by his bright rosy reflections against the clouds, to be but very little below the northern horizon. Plainly there can be but little chance for the electric aurora to shine among the rosy fingers of the due northern solar aurora. As in those regions the electric process causing the aurora occurs almost every night when there is little or no twilight, so we may presume the same process continues when a strong twilight hides the boreal aurora, especially since we know that auroras may be indicated by the magnetic needle when they are not actually visible to the eye. Our present reports from the far north lead to the supposition that the auroral process is more frequent on some meridians of longitude than on others, and that it is effected by geographical causes. Probably also many reporters, being exploring travellers and not scientific observers, have thought the fainter and less conspicuous auroras unworthy of record; and hence Prof. Loomis' small number of eighty per annum for the maximum average in any zone.

Both Capt. Franklin and Dr. Richardson testify that "the auroral phenomena are frequently seated within the region of the clouds." Hood states that he saw the aurora several times only six or seven miles above the earth's surface, among others, on Oct. 23, 1819, and June 13, 1820. I have observed similar cases. All the facts agree best with the idea that the liberation of the electricity causing the aurora takes place daily within the atmosphere, and that thence it escapes southerly by the three paths I have mentioned. The constant flow of electricity from the north requires in that region a constant supply. This supply must be afforded by the constant flow of the atmosphere to the north from the equatorial regions where at its very start it is charged with electricity by simple evaporation from the saline waters of the oceans. For it is a well known fact that positive electricity abounds in all vapors from waters only slightly saline. It has long been remarked that terrestrial magnetism and atmospheric electricity seem intimately connected. They cannot depend on geological causes, for we see nothing in the mineral constitution of the globe to produce such variable phenomena. They must depend on the radiations from the sun, either directly in part by changes of temperature, as Faraday thought, or indirectly by some other means, such as evaporation, condensation, friction of atmospheric strata and the like. Mysterious as the whole subject now appears, it is nevertheless plainly a soluble question, and awaits only the coming man armed fully with physical and meteorological science and having patience to give the problem a few years of undivided attention.

#### On the production of BRACTEA in LARIX.

BY THOMAS MEEHAN.

I have no desire to press with undue force on my fellow-students in Botany the importance of the discovery I made last year, that many of the great differences we see in varieties, species or even genera in Conifers, are reducible into the simple question of axial vigor; but the key it furnished enables me frequently to unlock some heretofore secret and mysterious

[August

cabinet of nature, and I have, therefore, to keep referring to it as the means to still more important ends.

Last year I had progressed only so far as to learn that foliage was governed by this law. I have since been able to show that the production of the sexes is governed in the same way. I can now show that the same law prevails in determining the form of the parts of fructification.

*Larix Europæa*, as in these cones exhibited, has the bractea scarcely as long as the scales, but I also exhibit other cones from the same tree in which the bractea are double the length of the scales, and some of them inclined to recurve in such manner that they much more nearly resemble the cones of *Larix Griffithii* of the Himalayas than they do those of the species to which they belong. In order more clearly to explain the law of their production, I will go over again part of the ground I have before explored, in order to make more clear the connection between past discoveries and the present one.

In the first year of infant life, vitality is not strong. The *Larix* is no exception. As a consequence of this light hold on life, the leaves are all entirely free from cohesion with the main stem or axis. The next year life is more powerful,—the axis thickens, and the leaves become mostly adherent, having only the foliaceous awns free. The Larch, of all trees, devotes the most of its strength to its main axis or stem. Year by year it accumulates strength in it, until by ten or twelve years of age it will frequently be able to make a growth of five or six feet in height of a single season. At this—the height of its vigor—the reproductive age commences.

The greatest stream of vitality flowing through the main axis, the side branches have a very weak development. In many cases the buds cannot push forth into shoots at all, but in such cases that law which gives corresponding strength to the leaves in proportion as it is abstracted from the axis, causes the leaves—true leaves—to grow in tufts or verticils, on small woody spurs. The axis in these spurs elongates every year; by slitting them, the annual gains of growth can be readily seen. Occasionally, by the accidental breaking of the point of the branchlet along which these verticils are situated, or from some other cause, the stream of vitality along that line is checked, it will flow again into these verticils or arrested axes, and though they may have been in the condition of spurs for ten or twenty years, they will again develop into branchlets, with adherent leaves, as in the regular course of things.

Coming now to the bearing age, we find along a branchlet of the preceding year's growth, before the growing season commences, numerous buds at irregular distances along its length. The stoutest of these buds branch out into new branchlets; the rest remain as spurs. None of these produce flowers on this, the shoot of the preceding year; but the next year a few of the strongest again develop into branchlets, a few more into verticils of true leaves on the spurs, more into female, and the balance into male flowers. All these different grades of vigor, and the consequences of the various grades are apparent in these specimens (exhibited). The highest grade, the development of the axis with adnate leaves,—the next spurs with free leaves,—the third with fruiting cones,—the fourth with a vitality so weak that, after the production of the pollen, the flower and whole woody axis immediately dies altogether.

Let us now pass from the Larch to a law of vigor recognized by every observer as common to all trees. If two branches push out together, and the one happen to get a little the start of the other in vigor, the stream of vitality in that will be continually getting wider and stronger; and just in proportion will the other lose. The strong branch in time will often take all, absorbing all the feeders into itself, leaving the other side stream dry. Thus the inside branches of trees, deprived of light and air, get weaker; and the more fortunate ones thrive in proportion. In the Larch this is beautifully illustrated.

1869.]

The inside branchlets get gradually weaker, until spur after spur in successive years loses the power of forming verticillate leaves, produces male flowers, the last effort of life, and then expires. Clear as I think the illustrations in my previous paper were to show that the production of male and female flowers in Coniferæ was a mere question of a relative flow of vital force, nothing can better illustrate it than this one of the Larch.

I now come to the chief point of the present paper—the influence of these laws of vigor in the modification of the parts of fructification. You will see in some of these weaker shoots, which in the production of male flowers most of the spurs have performed the last sad offices of life, a few have had just enough extra vigor vouchsafed to them to produce female cones and that it is just these weak cones which produce the lengthened bracts. I have compared with those of *Larix Griffithii*.

I have said in my paper on "Taxodium and Penus," in reply to an objection that my point as regards *Glyptostrobus sinensis* and *Taxodium distichum* being the same thing, is probably wrong, because the parts of fructification differ in each, —that as these parts of fructification are but modified leaves, the same law of change ought to operate on them as well. This instance of *Larix* proves it to be so. The bracts in Coniferæ are modified leaves, and the carpellary scales modifications of the woody axis. According to our now fully demonstrated theory, the leaves of Coniferæ are free, and become fully developed just in proportion to the weakness of the woody or axillary parts. This law might be expected to show itself in force in the bracts of the cone, as it is seen it really does in the specimens before us.

I am often asked what influence this law of vigor, as modifying form, is to have on our ideas of specific character? To me it seems the tendency will be to make our recognition of distinct things clearer, rather than to confuse them. As it is now, science on its present basis contradicts our senses. Every one knows a larch, a spruce, a fir, or a cedar, almost instinctively at sight; but no sooner were the rules of our best botanists applied to them, than no one knows which is which, and they are all thrown together in one genus. By pointing out the directions of change on one unvarying law, applicable equally to a whole genus or natural order, certainly affinities must be brought clearer and closer together, than by the present system of conjoining a few special points, many of which have no physiological relation to one another.

September 7th.

DR. RUSCHENBERGER, Vice-President, in the Chair.

Twenty-one members present.

Thomas Meehan said it was well known that all vegetable physiologists taught there were two classes of buds in plants, one called *adventitious* buds which had a kind of nomadic existence, springing anywhere from root or branch in apparent defiance of law or order,—the other *axillary* buds which were supposed to owe their origin to the leaf from the base of which they spring. It was customary to speak of these as the "parent leaves of the axillary buds." He would show that the leaf not only did not aid the axillary bud formation, but was rather a foe to bud development. He exhibited vigorous shoots of the Kentucky Coffee Tree, Honey Locust, Virginia Itca, Hickories and Walnuts, showing what had either been entirely overlooked by other botanists or passed over as of no importance, that there were in these two or three buds instead of the usual single axillary bud, one above another in a direct line, and that in all these instances the one the farthest removed from the base of the leaf, and of course the one the least under its influence, was the largest and best developed. These facts he had already incorporated in a paper read before the American Association at Salem last month. He

[August,

had since extended the observations so as to get proofs of the same principle from single bud cases. He exhibited specimens of some maple shoots of the present season's growth and showed that there was a gradual diminution of strength in the leaves from the early spring to the present time; *but just in proportion as the leaf lost in vigor the axillary buds gained in strength.* The upper buds were large and plump, the lower scarcely discernible. The inference was made clear, from these illustrations, that whatever may be the cause of the simultaneous appearance of leaves and axillary buds, they were not in harmony together.

He further suggested how very important it was that botanists should note well the most trivial phenomenon. These facts, which bid fair to revolutionize one of the most popular dogmas in vegetable physiology, had all originated from the single observation that the glands on the leaf stalks of the common wild senna weed, *Cassia marilandica*, were not always in one fixed position, and could not, therefore, be an elementary part of the regular leaf system. They were afterwards found to be buds which had been devoured, as it were, by the leaf, and actually absorbed into its structure.

Mr. Redfield noticed the finding of *Aspidium aculeatum* in the Catskill Mountains, two degrees farther south than it had heretofore been observed.

---

*September 14th.*

DR. LECONTE in the Chair.

Nine members present.

---

*September 21st.*

DR. RUSCHENBERGER, Vice-President, in the Chair.

Sixteen members present.

---

*September 28th.*

DR. BRIDGES in the Chair.

Twenty members present.

The following gentlemen were elected Members:

Jas. Cumisky, M. D.; T. H. Struts; Nathaniel E. Macomber;  
Wm. H. Fynn.

Prof. Geo. H. Cook, of Princeton, N. J., was elected a Correspondent.

---

*Oct. 5th.*

DR. RUSCHENBERGER, Vice-President, in the Chair.

Eighteen members present.

The following papers were presented for publication:

"Meteors, their composition and the cause of their ignition and of their white trails." By Jacob Ennis.

"On the variations of the Genus *Ægiothus*." By Elliott Coues, A. M.

1869.]

The publication of No. 2 of the Proceedings for 1869 was announced.

---

Oct. 12th.

The President DR. HAYES, in the Chair.

Twenty-eight members present.

The following paper was presented for publication: "On the Law of Development in the flowers of *Ambrosia artemisiifolia*." By Thomas Meehan.

The death of Mr. Frederick Klett was announced.

---

Oct. 19th.

DR. BRIDGES in the Chair.

Fifteen members present.

---

Oct. 26th.

The President, DR. HAYES, in the Chair.

Twenty-six members present.

The monthly report of the Biological and Microscopical Section was presented.

On favorable report of the Committees, the following papers were ordered to be published:

**On variation in the Genus *EGIOTHUS*\***

BY ELLIOTT COUES, A.M., PH.D.

Study of this genus will show a series of facts apparently of some general application, on the question of the mutual relations, if not actually of the origin, of the various forms, usually held to be species, that compose associations of corresponding grade. It is not to be supposed that this genus has labored under any peculiar or isolated conditions, or been subject to any special laws of development that have resulted in the state of things that is found to obtain. Whatever these conditions and laws may have been, they are presumably in fact, almost certainly—equally operative upon more or less allied groups. Though it seemed to the writer, at one time, that there was something peculiar in the kind of variation to which Red-polls are subject later investigations render it probable that such is not the case. Analysis, therefore, of the phenomena of this one group, carried into details, may be the means of deducing some generalizations not wanting in import.

It is not proposed to consider how the genus *Egiothus* became what it is,—that is, by what means it secured individual existence as an entity distinct from all surrounds, differentiated by certain characters from the most nearly and most remotely allied types, that is a question of the origin of genera,† foreign to the present subject. We are to take the genus as it now is and study characters of the grade next below generic in the hope of tracing some of the laws that have been effective in sorting out, among the birds of the group, the precise features they are found to possess.

---

\* See these Proceedings, Nov. 1861, p. 373, et seq., and Feb. 1862, p. 40.

† See Cope, Proc. Acad. Nat. Sci. Philad., Oct., 1868.

It is immaterial what name is given to the several assemblages of individuals that make up the genus. Some authorities admit but one, or at most two, "species": others six or eight. With a common standard of reference, both parties cannot be right. If there be such a standard in nature, not dependent upon the minds of ornithologists, the difference clearly results from the fluctuating position that the latter have assigned to it; and a human fallacy, one way or the other, is implied. If, on the contrary, no such standard exists, one of the above mentioned views is as true as the other. As will be seen in the sequel, the probability is that the latter proposition comes nearest the truth. At any rate, during this discussion, until some conclusions are reached, the terms "variety," "race," and "species" will be used interchangeably, as may be most convenient for the designation of such groups as it may be necessary to speak of,—not in the conventional sense that these words have gained. And by the term "*Ægiothus*" I wish to be understood as referring, not to the abstract idea of the genus so designated, but collectively to the million or more individual birds that are to day living upon the earth, as the concrete expression of the genus they constitute.

It is demonstrable, I believe, that these birds constitute a genus; that is, that they are separable from all other birds whatsoever, by a set of characters of higher grade than those by which they have up to this time been differentiated among themselves. There is no break or flaw in the bird by which it is possible to circumscribe them. There is no shading into or graduating towards this or that allied generic group. No bird has yet been discovered of which it cannot be predicated, without qualification, that it either is, or is not, one of the *Ægiothi*. If it is, it will be found to exhibit the following combination of characters: and no bird, not presenting just this combination, is an *Ægiothus*:

The culmen barely or not curved, as long as the middle toe without its claw, and not over four-tenths of an inch long; the upper mandible beset at base with retrorse plumules, more or less concealing the nostrils; the lower mandible without ridges; the point of the wing formed by four primaries, of nearly or absolutely equal lengths; the length of the wing from carpus to tip barely exceeding one-half the total length from tip of bill to end of tail; the tail four-fifths to five-sixths of the length, forked, with broad, rounded feathers; the middle toe without its claw not over two-thirds as long as the tarsus; the hind claw longer than its digit; the crown of the head some shade of crimson; the colors of the back not in well-defined areas; the rump lighter colored than the rest of the upper parts; the adult male with the breast of some shade of red, and the throat unstreaked.

It is common to speak of the "type of a genus," and in this instance *A. linarius* is generally held to be such. But it is evident that if the above characters of the genus were to be drawn exclusively from this species, they would be rather specific than generic, and would require qualification. A diagnosis drawn as closely from *linarius* alone as the foregoing is drawn from the six or eight forms together, would exclude at least two,—*rostratus* and *canescens*. In fact, if such expression be allowable, it may be said that *linarius* rather exaggerates than typifies *Ægiothus*; that is, makes *Ægiothus* out to be more different from other birds than it really is; for *rostratus*, for instance, in the features of size and shape of bill, more nearly resemble *Linota* or *Leucosticte* than *linarius* does. It is only by weighing all the phases of the genus together, taking an average, and weighing this against other averages, that a diagnosis of the genus can be obtained. Upon this method I have framed the foregoing definition, which I believe applies to *Ægiothus* alone; and, as has been premised it is highly satisfactory to find that the subject in hand may be so definitely limited. I see no "type" of this genus, except in an ideal—certainly no known existing—bird, that combines the attributes of all, without presenting exclusively the special characters of any, of the species.

If there was ever a time when all the then existing *Ægiothi* resembled each other as closely as those now called "*linarius*" do,—in other words, if the ge-

was ever unspecific, and has since by whatever causes been made otherwise by differentiation of several phases, then *linarius* was perhaps the actual type of the genus. But as at such time the genus was then rather forming than formed, it is more probable that the characters of *linarius* (i. e., of *Egiothus* in its entirety) were then specific only in relation to such types as *L. alba*, *Leucosticte*, *Chrysomitris*, &c. So at any given moment in bird-life a generic type or plan is an ideal induction of ours, rather than a material existence.

It is true, nevertheless, that at present *linarius* is the most common and widely distributed aspect of *Egiothus*, and that it comprehends a larger percentage of *Egiothus* than any other form. Were it the only phase of *Egiothus* now living, we could handle the genus in much the same manner as we shall have occasion to with consideration of other forms. I shall for the present assume that *linarius* is *Egiothus*, and see if it is possible, upon this hypothesis, to account for the balance of *Egiothus* that are now living more rationally and naturally than they can be accounted for upon any other premise.

It is specifically characteristic of the "typical" (i. e., normal, or most usual and general) *linarius* to be, 1, under six and not under five inches long, 2, with a wing 2.75—3.00 inches long, 3, a tail 2.25—2.65 inches long, 4, a tarsus equal to the middle toe and its claw, 5, a bill compressed-cone, very acute, with not appreciably carved culmen, and never wholly yellow or wholly blackish, 6 the light and dark streaks of the back about equal in amount, and mingled with an intermediate color, 7, the rump never wholly unstreaked, yet always lighter than the back, 8, the male sex indicated by a bright color on the breast and rump that is between deep crimson and pale rose, yet not reaching, under mature conditions, either of these extremes.

It is to be observed in the first place, that a large per cent—perhaps 50 or more—of *Egiothus* have preserved these special conditions inviolate. Upon these birds neither geographical regions latitude, longitude, climate, or any other perturbing influences have exercised the slightest appreciable effect. Specimens from all parts of Europe, from Hudson's Bay, New York, Southern States, Kansas, Oregon, Sitka and Asia, may be found as closely resembling each other as birds from the same nest ever do. In short, there are no differences. As similar *Egiothus* as I ever compared were from, respectively, Germany and the Rocky Mountains; and probably more than half the specimens at present existing in all the collections in the world will be found thus correlated. So it is a fact that, whatever influences have been brought to bear upon *Egiothus* tending to produce, or producing its differentiation or forking into several recognizable channels, such influences have been not in effect upon most individuals.

This is the first broad fact to be remembered. It is not an isolated one. On the contrary, it is one of a parallel series of large extent. In the cases of a number of boreal and arctic types, as *Nyctea*, *Surnia*, *Picolia*, *Ampelis* sp. and *Plectrophanes* sp., among land birds, and still more among natatores as the glacial *Laridae*, *Anatidae*, *Alcidae*, &c., we find the Nearctic the same as the Palearctic; and generally, the more nearly circum-polar types are, the more likely it is *ceteris paribus*, that distinctions between these two regions will be reduced to zero. It is to be observed, further, that *linarius*, besides being in longitude the most widely dispersed phase of *Egiothus*, is at the same time the most restless element of its genus. It has properly no special abiding place, its movements are irregular, almost spasmodic, it is found as far north as most, if not any, other forms, and, at least in the United States, ranges further south than any. I think it probable that the clue to its singular constancy is to be found in this fact individuals not being subjected through series of generations to precisely the same climatic and other influences, in consequence of which the equilibrium, so to speak, is preserved and variation in this or that special direction opposed. This inference seems just, and is corroborated by the fact, about to appear, that the more geographically re-

[August,

stricted a certain per cent. of *Ægiotus* is, the more decidedly and extremely does such per cent. differ from the rest.

1. To take up this point next: A certain part of *Ægiotus*—perhaps only one or two per cent.—now live, and probably always have lived, in Greenland. A few years ago this fraction of the genus received from Mr. Gould the name of "*canescens*," in reference to a certain condition of plumage. By this word we may summarily imply the fact that these birds differ from *linarius* in the following particulars: 1, larger size, averaging six inches in length, with wings and tail to correspond; 2, a less compressed, less acute, more regularly conic bill, differently colored, with heavier nasal plumules; 3, not correspondingly enlarged feet, the toes, especially, being relatively shorter; 4, marked deficiency in coloring matter of the feathers, which makes the whole plumage a more hoary-whitish, leaves the rump pure white, reduces the streaking of the under parts, and lightens the red of the adult ♂ to a pale rosy. These are simply observed facts, not open to cavil. It is also a fact that these physical condition of Greenland *Ægiotus* represent the extreme of differentiation that *Ægiotus* has yet attained; for no known bird of the genus differs so much from the common standard, *linarius* as *canescens* does. These facts are to be reasoned upon in connection with the following considerations:

As just stated, *canescens* is the most local, as well as the most boreal, demonstration of the genus. It is confined to Greenland; at least, it only reaches its characteristic manifestation in that country. Though quoted from North America, the citation is held, upon the best of grounds, to be erroneous. It is recorded from Northern Europe; I have seen no typical specimens from such localities; if really occurring, they can scarcely be regarded as more than adventitious. All other styles of *Ægiotus* range over more ground than this one: if then, according to any laws whatsoever, extraneous influences effect permutation of individual characters after a sufficient number of generations, we should expect such causes to be more efficiently operative in the case of the Greenland birds than in any other. Such is found to have been the case. *Canescens* has for an indefinite time been subjected to certain special, if not exceptional, conditions, with the witnessed result as above detailed; which is tantamount to a demonstration of the assertion already made, that the most local *Ægiothi* are the most specialized ones.

The fact of this greatest differentiation settled, we have next to inquire how far the particular kind of modification that has been brought about is amenable to certain laws that have been found of extensive applicability. I think that, with perhaps one exception, all the distinctive features that *canescens* presents are explainable by reference to some of these known laws.

An increase of size, coincidently with increase of latitude, has been shown by Baird\* and others to be of wide application in the cases of species ranging over many degrees of latitude. It is unnecessary to cite examples. The case of *canescens* vs. *linarius* is a parallel one. If it be objected that in this case we are dealing with two distinct "species," instead of variations in a single species, it is to be replied that the "specific" distinctness of *canescens* is precisely the point at issue, not a proven theorem. Moreover, it is to be observed that this distinction in size is one especially marking, not birds that migrate over a great extent of country, but those resident species, individuals of which are comparatively stationary, some living north, others south. It is here that the law comes most clearly into play, and *canescens* is the only set of individuals that conforms to this requirement; the others (with possibly one exception) are more or less migratory. So we can see why *linarius* taken at Hudson's Bay and in Carolina should be of the same size, while *canescens* surpasses their dimensions.

Whether as effect of climate, adaptative modification, or pure incidence (but more reasonably the former), the fact remains that a large number of genera

---

\* Baird, B. N. A., *passim*, and Am. Journ. Sci. and Arts, 1866, p. 20.

more or less arctic present white forms. Among mammals it is only necessary to allude to *Ursus*, *Canis*, *Lepus*, &c. Among birds may be cited the *Lagopus* from the *Tetraoninae*, *Meropuleo* and *Nyctea* among raptures, and in the present family of the *Fringillidae* certain species of *Plectrophanes*. Looking to water-birds it is observed that in the large cosmopolitan genus *Larus*, nearly if not all the tropical and temperate zone species of which have the back black or blue, and the primaries crossed with black, the glacial species (e. g. *glauca*, *leucopterus* &c.) have not this color on the wings, and the mantle is very pale, or even white, as in the case of *L. hutchinsoni*; the exclusively boreal *Larus* genus *Pagophila* is all white. It is the same with the most boreal greese *Hyperboreus*, *rossii*, &c. Among *Procellariidae* the most glacial genus, *Fulmarus*, is the palest, and an antarctic species, *Thalasseica antarctica*, is similarly paler than most of its allies. The modifications of color that the Greenland *Egypus* have sustained are exactly homologous. This is too evident to call for argument. Moreover, besides the whitening of color, it is a matter of common observation that pelage of mammals and plumage of birds is likely to be increased or otherwise modified in cold regions, or even at colder seasons of the year for an evident purpose. The covering of the skin is increased in two ways by thickening over parts already covered, and by extension over parts originally naked. The feet of the Ptarmigan, of the Snowy Owl, of the Northern Hare, are good illustrations of the last. Now in *canescens* we see both these methods in play. There is a peculiar soft thick mollipitose condition of the plumage, not seen in other species, and the little modified feathers that surround the base of the upper mandible are lengthened and thickened till they form a dense ruff concealing the nostrils. It may be also remarked, by the way, that this ruff is one of the diagnostic characters of a large group, although a true subfamily of *Fringillidae*, many if not most of the species of which are more or less boreal birds.

One other feature of *canescens*,—the want of enlargement of the feet in correspondence with increase in other dimensions,—I shall revert to in another connection.

As the case stands with *canescens*, few if any ornithologists would deny this fraction of *Egypus* "specific" rank. But if the laws that we have just been noticing have any meaning,—if they are not mere word-formulas, shallow and insubstantial,—there is no reason to suppose that *canescens* was not at one time *linnaei*, nor that, if the physical barriers—the geographical restrictions—that now hedge it about were taken away, and it were permitted free migration and unrestrained commingling with other *Egypus*, it would not revert to *linnaei* in the same length of time, or less, that was required for its aberration.

It seems to me that the special conditions and relations of *Egypus canescens* give it forcible bearing upon the generic question of the origin of species, and it is evident on which side it stands as witness.

II. A correlation of species in the matter of size, other than that just spoken of as dependent upon latitude, is frequent among birds. It may be accompanied by apparently unimportant, and certainly not very noticeable, differences in color, proportions of parts &c., a correspondent variation of the bill being among the more common. This law, so to speak, reaches a maximum, as the writer has shown\* in certain pygopodous birds. In the families *Columbidae* and *Podicipidae* in fact, it is possible to range the species in two parallel series, one of which is the counterpart of the other in case of almost every species, in nearly everything but size. Thus there is a larger (*C. Adamsii*) and smaller (*C. torquatus*) Loon, a larger (*articus*) and smaller (*pacificus*) Black-throated Diver, a larger (*holboellii*) and smaller (*griseigena*) Red-necked Grebe, and so on. The three North American species, so called, of *Accipiter*, are admirable illustrations. Examples without number could be advanced, but

\* Proc. Acad. Nat. Sci. Philad. 1862, p. 228.

these will suffice. In all these instances the foregoing law of increase in size with latitude has no part; for these birds always may be, and as a matter of fact, usually are, more or less associated. The genus *Egrotus* is thus subject to this special kind of variation, which remains as yet unexplained.

There are in Europe, and probably also in America, two races of White-bellied Red-polls, that differ from the ordinary style of *Egrotus* in little or not at all. One is smaller, the other larger. The latter has, in addition, a somewhat (but barely appreciably) larger and more yellowish bill than average. None of these points, even that of size, are sufficiently marked to be reliable and unmistakable except in the extreme; they have as yet reached no intermediate individuals now living complete a gradation from one to the other. This form is called *Egrotus holboëlli*, after Bohm; it has been known for a few years. It is found in northern and western Europe, and also with us; and I have seen identical samples from Canada. The smaller form has been longer known. Though usually credited, as *Fringilla monticola* Vieillot, somewhere about 1817, it was an old entry in the books at least. Brisson describes it with his usual accuracy; Müller has it in his *Systema* of 1776, as *F. cabaret*. Although authors speak of a notable amount of difference in the plumage, over and above that commonly exhibited by *monticola*, I am inclined to suspect that this is exaggerated. Very young *monticola* are always rufous; and it is credible that, age for age, and season for season, the difference in the colors of *rufescens* and *linarius* is not very tangible. In this respect, then, is the main if not the only point in this, as in the former case, where *rufescens*, as surely as *holboëlli*, grades in this respect with *monticola*.

Were these larger and smaller birds separated from each other according to age by geographical range, and particularly by a difference in latitude, we could argue more plausibly concerning them. In such case, even the slight difference that exists might be traced to some cause, and be regarded more as a consequence, in a classificatory point of view, than it now appears to be. In the larger bill of *holboëlli* we might see the operation of the same cause (however obscure their special determination may be) as those that have enlarged the bills of all the White-bellied Nuthatches west of a certain line, enlarged the Florida Crows' bills, turned the California Kingbirds' bills yellow, strengthened the claws of the Arizona black Pipit, thickened the bills of western Mocking Thrushes, put warts on the bill of *Agelaius*, and made a thousand modifications corresponding in degree to the geographical extent of each. As the case stands, we are totally in the dark. We must therefore content ourselves with bare statement of the fact that a certain part of the *Egrotus* have proven susceptible to some special change, which has consequently undergone certain modifications that the ordinary *monticola* have successfully resisted. If we go further, we are on speculative grounds. We may conjecture that these two races have been separated; that they began to be differentiated within the last few thousand years, more or less; and that in the process of time they will become more and more distinctly distinct, the differences that they have become possessed of being of advantage to them; or that they will eventually revert to the original type, the differences proving useless. A supposition as little founded on fact as it is refuted, except by analogical reasoning.

At present, ornithologists are very properly indisposed to look upon these birds as anything more than "varieties" of *linarius*, and to regard them as satisfactorily defined varieties. But I hold it to be demonstrable that the characters that separate these birds from *linarius* are of the same kind, and of different degree, or intensity, so to speak, as those that separate the White-bellied Red-polls from *linarius*. The characters of all the *Egrotus* are of the same kind as they can be, to the same level, and shown to differ only in the degree of expression. I see no means of distinguishing any set of them from each other as species. Intermediate links of the chain are easily found, and are so strong that the whole so firmly that there is no break in the series between the

smallest and darkest, and largest and lightest sets of individuals as yet discovered. To prove this I must bring forward the curious variations that *Egrotus* has sustained in northern North America.

III. I discovered in Labrador, in 1860, and soon after published a description of, a small Red-poll that I called *fuscescens* on account of its color. Specimens had before, however, been collected, and I am inclined to think this form is the one figured by Audubon for the common species; but *fuscescens* is, as far as known, its earliest designation. These Red-polls have since been traced quite across the continent, in British America, to Sitka; specimens are contained in nearly all the collections from the interior. With this extensive range in longitude, the birds' latitudinal dispersion is rather unusually limited. They appear to be mostly confined to boreal America, rarely entering the United States, and then only along its northern border; at least, I have seen no good examples taken further south. Throughout British and Russian America they are liable to be associated with true *linarius* at any point. In Labrador, however, they are the prevailing, if not the only form. They are also associated in the interior and on the west coast with another "species," to be noticed presently. It is difficult to estimate their numbers relative to those of the two other species: perhaps they are one for ten or twenty, or even in less proportion. These birds differ from *linarius* in, 1, smaller size, though this is not very evident except on striking averages: 2, in relatively and absolutely larger, heavier, and wholly blackish bill, furnished with unusually short and sparser plumules: 3, in color, which is above dusky, scarcely relieved by lighter streaks, the rump only a trifle lighter than the rest of the upper parts, the sides very heavily streaked with dusky, and the red of the male breast intense crimson.

The form is not to my knowledge found in Europe. Whatever causes have operated to produce this special modification in *linarius*, they have not been effective in Europe, and have moreover in America only affected a small per cent. of the total number of individuals. The resulting changes I cannot attempt to explain. Besides being not referable to any known general laws, they are in direct opposition to these. Climate, geographical position, &c., should, as we saw so satisfactorily in the case of *conscens*, have enlarged and blanched these birds, and given them heavier plumules, whereas we have the contrary condition. We might suppose, indeed, that the wide dispersion and irregular movements of the Dusky Red-polls may have interfered with the equable operation of the laws just alluded to, but this does not account for the

Lawrence, also, the result obtained

Lawrence, also, the result obtained

nature of the food obtained there, &c. I noticed nothing, however, in Labrador, that seemed sufficient for such end. It would be interesting to have information upon this point from observers in the interior of Arctic America.

If *canescens* has been shown to have probably been at one time *linarius*, and subsequently modified, as we have seen, by the operation of known laws, I see no reason for supposing that *fuscescens* is more distinct because we cannot so readily trace the laws under which it has been made what it is. We have only to take for granted, in this case, either a later departure from the common standard, or, what is more probable, a less regular, continuous, and consentaneous operation of modifying influences. In *rufescens* and *holboëlli* the effect of these influences is as yet barely apparent; in *fuscescens* it is already very evident.

In Greenland, side by side with the blanced mollipilose *canescens*, we have a few singular *Ægiothi*. It seems as if they had sprung like offshoots from *fuscescens*, and there in Greenland, stationary or nearly so, and isolated, the law of latitude had come into play to enlarge them; but that further interference with fuscescent features had not been experienced. These *Ægiothi*, that I call *rostratus*, are: 1, as large as, or scarcely less than *canescens* (about six inches long); 2, with a bill that is even an exaggeration of that of *fuscescens*, being still larger, thicker, more turgid, with short plumules, and black in color; 3, with the colors of *fuscescens*, the heavy stripes on the side being sometimes carried quite across the belly. There appear to be fewer of these than of any other *Ægiothus*; I have not seen a dozen in all, and none except from Greenland. One or two of these are appreciably lighter than the rest, and in fact, shape of bill and total size apart, rather recall dull plumaged *linarius*. I scarcely know what to make of this form, after accounting for its size as above, and prefer to leave it with this simple statement of fact. In a classificatory point of view, it appears to hold somewhat the relation to *fuscescens* that *canescens* or possibly rather only *holboëlli* does to *linarius*. Though I did not reach such opinion in my monograph of 1861, I should now, in spite of its several very obvious peculiarities, consider its characters, in relation to those of *fuscescens* or *linarius*, as of less systematic value than those of any "species" except *rufescens* and *holboëlli*. The small number of specimens at my command will not allow me to expose the precise degree in which it graduates towards *fuscescens*; but it is probable that some such assimilation occurs, and that nothing but the birds' isolation in Greenland prevents them from shading insensibly into *fuscescens*.

IV. Perhaps the most interesting modification of *Ægiothus* remains to be noticed; I refer to what I call *exilipes*. Audubon figures it by mistake for *canescens*, which I presume he never saw; and Elliot has recently given another illustration. It is the "mealy red-poll" of American, but not of European, writers. The peculiarities of *exilipes* do not occur, so far as known, in Asia, Europe, or Greenland, but they are characteristic of a large number—perhaps the majority—of boreal and arctic American *Ægiothus*. These modified *Ægiothi* do not come so far south as *linarius* does; in general they may be said to be confined to British and Russian America, though some appear to occasionally pass the northern boundaries of the United States in winter. They are very generally dispersed, being contained in almost every collection sent from the interior and the north-west coast, but are perhaps more abundant westward. They are migratory, if irregularly so. They sometimes seem, judging from collections, to be the only form in some localities, but more generally they are associated, if not at the same season of the year, with *linarius* and *fuscescens*.—Sometimes both. It seems as if there were a wave of *linarius* swaying north and south, between certain parallels of latitude; another of *exilipes* between certain higher parallels; yet the two regularly meeting on common ground, and each tending and preying still further in the direction of the other.

The characters of *exilipes* are these: 1, size of *linarius*; 2, colors (very  
1869.]

nearly) of *canescens*; 3, a smaller, more regularly conic bill than *linarius*, generally rather dusky than yellow, and with extremely heavy plumules. 4, remarkably small feet, produced mainly by absolute shortening of the toes. We have here a unique assemblage of characters, the modification that this per centum of *Egothus* have undergone is not just like that of any other climate, apparently has, as in the case of *canescens*, done what might have been expected in respect to color—it has bleached the tints into the semblance of those of *canescens*, taken away the stripes from the rump, leaving this largely and purely white, and reduced those on the sides to a minimum, whitened the edges of the wing and tail feathers; made the rosy puler, and thickened the nasal plumules. Latitude on the other hand, has not effected any perceptible increase in size. This is curious, viewed beside the case of *rostratus*, in which size is increased, but color unaffected. Superadded to these changes is the singular modification of the feet.

As is well known absolute size of these members, and relative proportions of the toes to each other, as well as to the length of tarsus, are among the more constant features that birds present. Only a narrow margin seems to be allowed in the same species, for variation in these respects. In fact, looking over the annals of ornithology, one is struck with the number of proposed species called "longipes," "brevipes," "brachydactylus," etc., that have subsequently been shown to be only accidental, or very partial modifications not holding good as a general rule. There are a great number of synonyms of this particular class, needing no more than this allusion. At the same time it is equally well known that certain closely allied birds do really differ in precisely this particular, —sometimes with other peculiarities superadded, sometimes with scarcely any, or none. A more or less decidedly terrestrial or arboreal mode of life may reasonably be presumed, if not logically inferred, to have something to do with this change. The case is better illustrated in comparing allied genera. Thus *Mimus* is an eminently bush- and tree-living genus; the species of its nearest ally, *Harporhynchus*, spend much of their time on the ground, walking and scratching among leaves, &c. The feet of the latter are correspondingly larger and stronger than those of the former. The same is the case regarding *Pipilo*, as compared with other allied genera less eminently, or scarcely, terrestrial in habit. If such modification can be traced in this grade of forms, I see no reason why it should not be exhibited, in however much less degree, between congeneric species that differ in a more or less decidedly arboreal mode of life. Admitting, then, possible modifications of the feet, in specific as well as generic grades —modifications correspondent to the nature of the foot hold that the birds habitually take,—there seems no reason why the argument by analogy should not be carried a step further, and made to include possible results from a difference in the kind of trees or bushes, or the kind of ground that arboreal or terrestrial species respectively frequent. Terrestrial sparrows of muddy situations will probably be found to have some modifications of the feet not shared by those of sandy deserts, or of rocky gorges. Bush-sparrows, as *Ammodrami*, that climb up perpendicular swaying stems, have not the same feet as their nearest allies among bush-sparrows that habitually rest upon horizontal and less yielding twigs. These are merely illustrations in point of what I wish to propose,—namely, that the small feet of *A. exilis* may be due to a difference in the size, texture, &c., of the trees or bushes that they habitually frequent, or are really confined to, as compared with the greatly varying range of footholds that *linarius*, in its extensive movements, necessarily takes. It does not seem irrational to suppose that the stunted resinous conifers that form so marked a feature of the northern flora may have produced, in the course of time, the modification that is now witnessed. However well or ill grounded the suggestion may be, it is at least a fair inference; and, at any rate, I know of no other assignable cause for the observed fact.

As intimated when *canescens* was spoken of, it is interesting to note that the

[Oct.

same condition of feet is found in that species. The feet, indeed, are larger than those of *exilipes*, and the tarsi, particularly, are long; but the toes are still notably short, in a relative sense, not having increased *pari passu* with enlargement in other respects. I would attempt to explain this fact in the same way.

So far as I know, the claws of *Ægiotus* have not been modified coincidentally with those changes that have made the several races what they are. The claws of *exilipes* and *canescens*, indeed, are longer, compared with the toes, than those of other forms; but this a relative, not absolute difference. The claws of all the species are liable to vary within rather wide limits.—this discrepancy belonging clearly, however, to the class of individual peculiarities.

The conclusions to be drawn from the foregoing facts are obvious. We have seen that *canescens*, the form most strongly differentiated at present, is also the one most easily accounted for by the operation of certain known laws that produce variation in species. If this were not a separate and independent creation, it must have been evolved at some time out of *linarius*. The question of its specific distinction, then, is merely a question of time; we can only say that it has divaricated further than any other known forms from the original standard, and that, though it has reached a point where most ornithologists would draw a dividing line quâ species, yet it is really only a variety of *linarius*. *A fortiori*, in the case of all the other above described modifications of *linarius*, we have varieties, not species. Simply, they have not progressed so far in the process of differentiation; they either began to be modified later, or the modifying influences have not been so effectual towards that end. But if *canescens* is a "species," so also is each of the others. There are only involved differences in degree, not in kind.

#### The Law of Development in the Flowers of *AMBROSIA ARTEMISIÆFOLIA*.

BY THOMAS MEEHAN.

In the fruit of *Ambrosia artemisiæfolia* the perigynium is crowned with a series of horns. I propose to show that these are all that remains of other flower buds, which have been absorbed by their elder sister during infancy.

It is not generally known that this species is occasionally dioecious, though Dr. Darlington in his *Flora cestrica* makes note of the fact; nor is it known to the mass of botanists that a peculiar form of neutral flower exists, though many years ago Torrey & Gray (*Flora of North America*) briefly alluded to it. These dioecious forms and neutral flowers afford the key to the whole structure.

In the regular form of this species the sequence of the flowers is according to the laws recently developed in my papers on sex. The female flowers receive the plants' first and greatest care, and always appear in the lines of strongest vitality, of which a vigorous axial development is one striking type. The male flowers only appear in the weaker lines, after the cohesive force so essential in building up the woody axis has been considerably spent. In the purely pistillate forms we almost always observe an unusual axial activity. The female flowers in the regular forms are sessile in the axils of the leaves; but in the mostly pistillate forms they are generally elevated on short peduncles, giving the plants a peculiar twiggy appearance. On the other hand, the nearly male plants, which by the way are rarely seen, present characteristics the reverse of these. The heads, usually female, when appearing as male flowers, exist as large burrs tightly set in the axils, without the slightest tendency to pedunculation. Though varying in intensity, and occasionally intermingling, no one can fail to see that these forces prevail in these forms—the feminine, in connection with cohesive and vital activity in the axillary parts—the masculine, with weakened axillary activity, and individualization.

The flowers themselves, however, afford a better illustration of this than the  
1869.]

supporting parts. The male flowers are five to eight in each involueral cup. —in the female they are single; but in place of flowers the female has five to eight horns on the perigynium. The want of correspondence in number in parts which were no doubt embryologically the same, together with a correspondence in the number of the horns on the perigynium would naturally suggest to one acquainted with the absorbing or coherent power of the female influence that the primordial bud had absorbed the rest, of which all that remained were these horns. This I subsequently proved to be more likely by the discovery of *two forms of perigynia*. Occasionally three female flowers appear in one involueral cup. In such cases the two lateral ones have, ~~usually~~, no horns, or rarely one or two, while the central one has but from four to six—evidently a less number than others which have no side flowers with them. In the male flower we find two forms—the perfect ones with five broad anthers, abundantly pollentiferous without horns, and without any attempt at producing a style. The other class has anthers which seem never to produce perfect pollen, but are projected into a scissiform inflexed appendage or horn and have a single sterile style which is capped by a numerously rayed stellate apex. Torrey & Gray *Flora N. M.* Page 290, notice this form of flower, but err in evidently believing it universal while other authors seem to refer to the former, ignoring or ignorant of the existence of the latter.

The absence of a style in connection with perfect anthers, and the attempted production combined with the deficiency of pollen in the neutral ones show an evident progress towards a female stage, and also it is clear that with this progression is a *tendency to cornution in the parts absorbed*. I pointed out to some of our botanical friends in the Academy some weeks ago, that from these circumstances the horns on the perigynium could scarcely be anything else but the *remains of absorbed flower buds*.

I have now found a specimen which affords the practical demonstration of these truths—a female plant not a foot high, with enough of the cohesive power to give it an entire female character, but not to the same extent that more vigorous forms possess. The horns are in *every state of gradation from their usual condition on the perfect perigynia to petaloid scales, down to perfect flowers with the regular turn styles*, though adherent by their bases to the central or main flower. Only for this early cohesion with, and thus a reception of the female influence, the lower ones would undoubtedly have been male flowers.

I present this specimen, together with a suite of the others referred to for the Society's herbarium.

I may be again permitted to repeat what I have frequently said already in papers before this and kindred associations, that there are probably in plants two distinct principles going along together—the one *hereditary*—a conservative, coherent, female force which, as the very existence of all things depends on it, nature throws in and around it her strongest vital powers—and variation a progressive, radical principle, the only object of which is to prevent stagnation, to segregate and disperse rather than unite and preserve—and by giving varied form to matter, is the source of the endless changes which give beauty and interest to the other. Less vital less essential, less cared for by nature because she reproduces herself by buds, tubers, suckers, roots, and many other ways *when she does not care for variety*, without it, but not so essential to our pleasures and intellectual progress, and indeed the eternal progress of all things.

I submit this paper as another contribution to a theory which may not yet appear to others so clearly a law, as it continues by almost daily observations to grow on myself.

Nov. 2nd, 1869.

MR. ISAAC LEA in the Chair.

Twenty nine members present.

The death of Dr. T. H. Turner, U.S.A., was announced.

[Nov.

*Nov. 9th.*

The President, DR. HAYS, in the Chair.

Twenty-nine members present.

---

*Nov. 16th.*

DR. RUSCHENBERGER, Vice-President, in the Chair.

Twelve members present.

---

*Nov. 23d.*

DR. RUSCHENBERGER, Vice-President, in the Chair.

Twenty-six members present.

---

*Nov. 30th.*

DR. RUSCHENBERGER, Vice-President, in the Chair.

Twenty-five members present.

The following gentlemen were elected Members :

Rev. Z. M. Humphrey and Henry C. Miller.

---

*Dec. 7th, 1869.*

The President, DR. HAYS, in the Chair.

Twenty-one members present.

---

*Dec. 14th.*

The President, DR. HAYS, in the Chair.

Twenty-nine members present.

The death of Benj. D. Walsh was announced.

---

*Dec. 21st.*

DR. RUSCHENBERGER, Vice-President, in the Chair.

Twenty-three members present.

The following papers were presented for publication :

"On the Classification of Water Birds." By Elliott Coues, M. D., U. S. A.

"Characters of some new Hepaticæ, mostly North American, together with notes on a few imperfectly described species." By C. F. Austin.

Prof. Cope made some remarks on a cranium of the *Hyperaodon bilens*, from the coast of Rhode Island, presented by Samuel Powell, of Newport. He stated that it was a female, which entered the harbor of the latter place with a male some time after cast ashore dead near Dennis, Mass., and 1869.]

was preserved complete in the Mus. Comp. Zoology, Cambridge. (See Allen, Mammals Massachusetts.) He said that the muzzle of the female was longer than represented for European specimens, but that that of the male was as short, and that no difference could be detected in the skeleton of either. He therefore retained the name of *H. bidens*. He stated that *Mesoplodon azerbim-  
is* also occurred on the coast of Nantucket.

He next exhibited the left ramus of the mandible of a finner whale, from the miocene of Edgecombe Co., North Carolina. He pointed out that its characters were nearest those of the *Eschrichtius cephalus*, but that there was a groove inside the upper edge of the jaw, that the nutritious foramina were much more numerous, etc., etc. He called it *Eschrichtius polyporus*.

He exhibited a number of remains of fossil reptiles, from Sampson Co., North Carolina, of cretaceous age, which were intrusive in miocene beds. Among these were humerus, tibia, fibula, metatarsus, caudal vertebra, and perhaps cervical vertebrae and ungual phalange of a *Dinosaur*, discovered together by Prof. W. C. Kerr, Director of the Geological Survey of North Carolina. The remains indicated a species having the same general form and size as the *Hodrosaurus foulkei*. The caudal vertebra was of very different form, and resembled more that of *Hylaeosaurus*, minus the diapophyses. This vertebra was elongate, depressed and angulate. The animal presented various other points distinguishing it from *Hodrosaurus*, and was named *Hypsidema crassicauda*.

Two caudal vertebrae of another animal from the same County, but different locality, indicated a true *Hodrosaurus*. One, near the thirtieth caudal, was twice the size of that of *H. foulkei*, the vertical diameter of the centrum being 4.5 inches. It presented so many peculiarities of form that Prof. Cope thought it to have belonged to a species distinct from *H. foulkei*. A caudal, apparently terminal, was shorter than the same in that species. He named it *Hodrosaurus tripos*.

Another reptile from the same locality was indicated by an elongate, conic tooth, and perhaps by others, which had the cone in cone structure of those of the species of the Crocodilian genus, *Thecachamps*. It differed from all these in the removal of the usually opposite dividing cutting ridges to a position near together on the inner face of the crown, and the slight median contraction of the crown, which produced an appearance of enlargements a short distance above the base and below the tip of the crown. Crown conic; length 2 in., 6 lines. He named it *Polydectes biturgidus*.

---

Dec. 28th.



## On the Classification of WATER BIRDS.\*

BY ELLIOTT COUES, A.M., M.D., PH.D.

Captain and Assistant Surgeon, U. S. Army.

By "water birds" is meant the swimmers proper, as distinguished from aquatic, or even natatorial, *Grallæ*. That the *Natatores*, so accepted, are one of three primary divisions of birds, at least of carinate birds, is held to be demonstrable. I shall attempt the proof, and endeavor to define the natural orders and families of the sub-class. I am authorized to state that the classification here proposed has been adopted without modification by the Smithsonian Institution, in the arrangement of the *Natatores* in its museum.

Not to allude to early classificatory schemes that the progress of ornithology has shown to be impossible, nor to those late systems, based upon the inestimable labors of Müller, Burmeister, Sundevall, Cabanis and others, that relate mainly to the arrangement of the higher groups, there still remain several that must be taken into the present consideration. Notably, those of Nitzsch, Vigors, Bonaparte, Lilljeborg and Huxley, which bear directly upon the subject in hand; notice of which is necessary before defining the modification of one of them that it is the design of the present paper to establish.

It may be here premised, and safely asserted, that heretofore no two ornithologists, bringing original research, and the conclusions deduced from it, into action, have been able to agree closely in classification. There are as many systems as there have been leaders in the science. But conflict in the field of taxonomy has been chiefly along the line of the higher groups,—more particularly *Passeres*. Respecting the *Natatores*, a singular unanimity has prevailed in the definition of the group; and in the main, similar subdivisions have been recognized, however differently these have been collocated, and estimated in the scale. Intermediate or "doubtful" forms are limited to two or three families. Only one author stands far apart from the rest in the distribution of natatorial families, assigning part of them among what are known as "*Grallæ*," and the others with certain insessorial types. These facts have perhaps another significance than that of simple matters of ornithological record.

Referring to the authors just mentioned, we find four principal methods of primary division of birds: (1) a dichotomous arrangement in two "parallel series," based upon one physiological character,—*Bonaparte*; (2) a trichotomous, founded upon very general considerations,—*Nitzsch*, and after him *Lilljeborg*; (3) a quinary, a modification of the second, by dividing two of the three divisions into two each, and with minor changes,—*Vigors*, and many others; (4) another trichotomous, but from a totally different standpoint—recognition of birds as modified reptiles—and carried out with special reference to one anatomical character, afforded by certain cranial bones,—*Huxley*.

After Oken's generalizations upon the condition of newly-hatched birds, Bonaparte made the scheme of *Altrices* and *Præcoces* his own by strenuous, unqualified advocacy, and elaboration of details with surprising care and skill. The system took strong root, and is held by many as the key-note of the natural classification, comparable, in equivalency, to such profound divisions as e. g., *Exogens* and *Endogens* among flowering plants, or *Placentalia* and *Monotremata* among mammals. That the system has been unduly stretched may perhaps be shown.

Comparison, for instance, of Bonaparte's two subclasses with those of placental and implantal mammals, may show how far the former may be

---

\*A considerable time has passed between the preparation and the publication of this paper. In revising the proofs I have added foot-notes, where comment or explanation seemed desirable, in preference to altering the original text; this is left untouched.

carried. There is, I believe, a perfect parallelism in the physiological point involved between mammals and birds; but it does not reach to the grade just supposed. In Marsupials, the condition of the young at birth is associated with a radical modification of the generative apparatus in both sexes. The sexual organs alone would enable us to predicate, regarding the condition of the foetus at term, a departure from the ordinary standard obtaining in higher orders, even were we unable to say in what the difference would consist. It is not so with birds; if there be any structural modifications correspondent to altricial and præcocial nature, they remain to be discovered. From nothing now known could either be predicated, in any given instance; our inferences would be purely upon consideration of known allied forms.

Marsupials are so far "synthetic" that they comprehend the semblances of other mammalian orders. There are carnivorous, herbivorous, quadrumanous, etc., marsupials. The number of forms that a given group may represent or repeat under modifications peculiar to itself, is a well-known test of the character of such assemblage, and in a measure of its grade in a taxonomy, only inferior to that afforded by the modifications themselves. Marsupials and Monotremes conform in both ways to the requirements of a primary division of mammals. But among birds, altricial and præcocial orders must be so drawn that, while they are mutually representative to a degree, as wholes, they do not include, each in itself, modified representations of each other. Thus, *e. g.*, in Bonaparte's parallel of altricial *Gavia* and præcocial *Anseres*, among swimmers, it is impossible to find families representing each other to anything like the degree, or in anything like the number of cases, that may be shown when *Natatores* are divided upon another basis, and the families differently worked out.

If helplessness at birth, compared with precocity, means, among birds, "high" as opposed to "low" in the scale, then either the reverse is the case with mammals, or else we must compare altricial *Insectores* with marsupials, and præcocial *Natatores* with the higher orders: a dilemma, either horn of which is sufficiently difficult.

I believe that the strongest analogy, if not actual homology and exact parallelism, between the altricial and præcocial series of birds, and certain conditions of mammals, really does exist. My meaning will be evident, if I simply refer to the difference between a kitten or puppy at birth, and a newly-born calf or colt. If all mammals are "altrices" by their very nature, as expressed in their name, there is a distinction with a difference in the two modes of exhibiting this nature. The young of one series of mammals are born weak and helpless, unable to stand, often blind and naked; the young of the

certain doubtful cases will probably be decided by reference to it. It draws a sharp, if here and there a broken, line between *Gallinæ* and *Columbæ*. It separates, with precision, Herons and their allies from other *Grallæ*. It goes some way in distinguishing lamellirostral from other Natatores; and other instances of its application might be cited.

Some other points are to be considered in this connection. The various conditions of single, double, and middle monogamy, and polygamy, are to be regarded. Some generalizations, apparently important, may be drawn from the comparative size of the air-space in the eggs of the two series.\* *Altrices* usually lay few eggs, *Præcoces* many; an evident adaptation to facilities of caring for young under the two régimes. Yet an immense group of præcoces—*Grallæ*—lay but four, which is below the average of altricial Insessores. There are also many families among *Rasores* and higher *Grallæ*,—too many to be considered as exceptions proving a rule,—in which altricial or præcocial characters are but doubtfully expressed, or else do not agree with unquestionable affinities in other respects. Finally, it should be observed that, as all Insessores are altrices, no parallelism exists between the great majority of existing birds and the præcocial series of walkers, waders and swimmers, the relationships between which and Insessores, if any, are only of remote analogy, not affinity. To speak figuratively: we come a long way,—the greater part of the whole way—down the bird scale, before meeting with any indications of difference in this physiological point. Arrived at the lower walkers, and higher waders, we first dimly see a certain principle striving, with uncertain results, to assert itself. Wavering for a while, at length it gains force and effects fissuration of birds into two or more “parallel”—i. e., self-repeating or self-representing—series: the main stem continues unaltered, through wading Herons to swimming *Totipalmi*, *Longipennes*, &c.; the fork, first distinct among some walkers, thence continuing through the smaller *Grallæ*, &c., to anatifform swimmers. This is a matter of observation, not an hypothesis; is it sufficient basis for a primary division of birds?

In the application of Bonaparte's principle to our subject of swimming birds, the results are seen to be no better than was to have been expected. It is difficult to say which one of this author's many schedules, variously modified, should be held most expressive of his views. That given in the *Comptes Rendus* of Oct. 31, 1853 probably does his classification the most justice. Here water birds form his sixth order, *Garie*, comprehending *Totipalmi* and *Longipennes*, and his tenth, *Anseres*, including all other Natatores. The two groups are separated by all the *Rasores*, the Struthious birds, and all the *Grallæ* except Herons. Beyond question, swimming birds, however viewed as to their subdivisions, cannot be separated thus; the steganopodous and macropterous Natatores cannot be separated from others by three, or by any, orders. Here they are made to differ more from other swimmers than the Gallinaceous and Coliatorial birds do. The structural differences between a penguin and a duck are certainly as great as those between an auk and a cormorant; yet in our instance the birds stand side by side in the system, in the other they are divided by intervention of three diverse orders. But a more serious objection to this schedule, and one, too, coming from the author's own side of the question, is found in the fact that *Urinatores* are not all *Præcoces*, as they were at this place represented. They were consequently subsequently referred to *Gruce*, and the penguins made a distinct order. But it so happens, unfortunately or otherwise, that neither are the *Urinatores*, with or without the penguins, all *Altrices*. In short, birds will not lie conformably disposed in the two Procrustean beds of *Altrices* and *Præcoces*. As far as known, all *Insessores* (q. d. *Columbæ*), *Herodiones*, *Steganopodes*, and *Longipennes* are *Altrices*; *Struthiones* and *Lamellirostres* are *Præcoces*; beyond these, neither can be safely predicated of groups of higher rank than families, without exceptions and reservations.

\* Cf., e. g., G. A. Lewis' Lectures on Ornithology, pt. 1, p. 17.

As the sum of the criticism I would be disposed to offer on Bonaparte's arrangement, I would say: Not to refer to *Rasores*, *Grallæ* and *Natatores* as varying exponents of two primes, altrices and precoces, but to regard the former as themselves the integers, of which "altricial" or "precocial" are predicable as exponents of modifications of which the three are alike susceptible. So, therefore, altricial or precocial *Natatores*, not natatorial *Altrices* or *Precoces*.\*

Nitzsch's earlier classification† was a dichotomous division of *Aræ* into *Carinata* and *Ratita*, after Merrem; an arrangement that anticipated the later one of Prof. Huxley in separating the struthious birds from those with a keeled sternum. He afterwards‡ became satisfied that *Struthionidæ* et aff. should come among *Cursores*, and divided all birds into *Ar. Aëreæ*, *Ar. Terrestres*, and *Ar. Aquaticæ*,—birds of the air, earth and water. These are difficult of precise definition in terms descriptive of structural modifications, in consequence of the occurrence of intermediate and aberrant forms, that furnish exceptions to almost any possible diagnosis. But it comprehends a broad, well-founded generalization, violates the requirements of no natural groups, and largely fulfils the main conditions of a natural system. If the point be well taken, it follows that birds—that Carinate birds at any rate—are modelled after three types, that, however modified or even changed into the semblance of each other in some cases, retain definite tangible characters. The system appears susceptible of a crucial test. If it be true, each one of the three main stems of the bird type must repeat or represent, with unquestioned fidelity, in some one or more of its branches, the other two. Among the orders and families into which, *e. g.*, *Natatores* are differentiated and specialized, representations of *Aëreæ* and *Terrestres* must be found; the relationships, of course, not of actual affinity, but of analogical resemblance. I think that the system will stand such test, and shall in the sequel apply it in some detail. Establishment of one of the three groups is tantamount to fixing the other two.

Nitzsch's *Natatores* are a suborder *Ar. aquat. palmata*, as distinguished from *Ar. aq. grallæ*. He adopts five "families," two of which are rather associations of families (*Steganopodes* and *Pygopodes*). He places the Flamingoes (called *Odontoglossæ*) in *Grallæ*. *Podici* he adds to *Steganopodes*.

The quinary system of Vigors,|| in its primary divisions, is a modification of the trichotomous just noticed. Disregarding subclasses, he proceeds at once to five orders. The two first are a division of *Ar. Aëreæ* into *Raptores* and *Insectivores*, according as the birds are habitués of the upper air or of the trees more particularly,—a distinction better borne out by actual structure of the birds than by reference to this assumed difference. Nitzsch's two divisions of *Ar. aq. Grallæ* and *Palmatæ* give, with scarcely a variation, Vigors' two last orders *Grallæ* and *Palmatæ*. Vigors' *Aëreæ* in the order *Raptores* comprises the galli-

By this means we should arrive at about a dozen orders of apparently the same taxonomic value.

With endless minor modifications at different hands, yet with main points intact, this system has come into general use, holding its own against many technical objections, with a vitality something remarkable in the history of the science. There is that about it that appeals strongly to general opinion, representing average "common sense," and commands assent, however qualified and guarded. The most extensively used, it is also the best abused system of all, particularly in that phase it gained at the hands of Swainson et al. Much argument, and not a little invective, has been wasted, or worse, upon the various "quinary," "septenary," "circular," &c., systems that have revolved like satellites around Vigors' standpoint. It must be vital, or it would before this have been buried. It must be weak at points, or it could not have been so successfully attacked. It appears to have suffered more from the indiscretion of its friends than the hostility of its enemies.

The child's "classification" is the placing of objects in a line one after the other. A step in advance is their arrangement in several contiguous lines, straight or waved, parallel, oblique or crossing. The insurmountable difficulty is that these lines lead anywhere,—nowhere in particular. Any linear arrangement is so clearly impossible, that I only excuse myself for alluding to it at all by taking it as the initial point of departure in this portion of the present essay. It was a stride onward when the idea was conceived of making these lines return upon themselves. Not only were otherwise inevitably bizarre juxtapositions done away with, but a greater end, the production of surfaces instead of lines, was secured. Anywhere in these planes, from centre or type-point to periphery or aberrant points, forms could be located. With the "circle," an indefinite number of points of contact or inosculation became possible. The circularian could bring his three, five, seven, or other "subtypal" forms around his "type circle," weigh the importance of each by the size of his circles, and grade relationships from near affinity to remote analogy. The elastic system seemed perfect with its machinery of "wheels within wheels." Criticism of this scheme has too often ended in a smile or a sneer, yet without touching upon the really vulnerable point. A system that disposes objects in circumscribed planes is a great advance over a linear arrangement, but it stops half-way to the goal. The third dimension is needed; to length and breadth must be added thickness: the circle must become a sphere.

Thus I conceive that every group of birds, from the assemblage of individuals called a species, to the very highest, constitutes or represents a solid of the three dimensions. We cannot predicate affinity or analogy only to the right or left,—the top or bottom,—but must take it that all groups, near or remote, may approach, touch, or fuse with each other, along the axis of either of the three possible diameters. With whatever result in our attempt to project an ornithological system on flat paper, yet we cannot imagine the groups to be all distributed in one plane surface, or even in several "higher" or "lower" parallel planes. Just as the stars, that appear scattered on a concave surface, are harmoniously distributed throughout space in its three extensions, so types of birds with reference to each other. The avenues of mutual approach, whatever their number, do not all lie in one plane, but may be in any of the perpendicular planes whose intersection generates a solid.

I use the word "sphere" merely as the general expression of solids with indefinite number of sides: not presuming to say that this is the real shape of birds as a unit, or of their subdivisions. Birds could only assume this form if developed equally in all directions, which apparently, I may say without error, is not the case. The figure may be conoidal, like half an hour-glass, the other half is reptiles, or only the Pterosaurian type of that class: the meeting at a point, perhaps *Archæopteryx*. Speculations upon the contour of the figure are, however, out of place. Again, the superficies of this solid, whatever its form, is not necessarily, nor even probably, smooth. We may

[189.]

conceive of it as presenting irregular callencies drawn out even into arm-like processes, reaching toward, or touching, mammalian, reptilian and piscine groups; or reentrances, into which are extended corresponding outgrowths from other forms of life. Classification is not the laying side by side of plane figures, circular or otherwise; but the piling over against each other of variously shaped solids, that meet and fit at mutually conformed and adapted points or surfaces of contact. The bird is laid against the mammal at the point *Struthio*; against the reptile at the point *Archæopteryx*, or rather by a surface of which this type was one point; against the fish (probably the Elasmobranchiate fish) at the point *Spheniscus*, and so on. Inside the figure *Avæ*, everywhere from centre to superficies, lie piled in certain order, all lesser figures, from species to sub-class, mutually fitting on every side. The problem is to discover, as nearly as may be, the plan according to which the several stones are shapen, coaptated in the building of the solid structure. We do not deal with an empty shell \*

Professor Huxley's classification† is materially different from any other. It is probably the most stirring ornithological event since the discovery of *Archæopteryx*. It is an attempt to classify birds with reference to a single set of characters—the modifications of certain cranial bones. The test is critically applied and rigidly carried out, necessitating a new division of the class, by breaking up most of the higher groups usually recognized, substituting others, and calling for a hitherto unsuspected sequence of orders and families. The primary division is into three "orders," apparently correspondent in taxonomic value with the "sub-classes" of most writers. *Saurura*, represented by the *Archæopteryx* alone; *Rutula*, including *Struthiones* et aff., seemingly about equivalent to *Platysternus* Nitz., *Brevipennis* Lillj., *Curacora* & *Curruca* affor; and *Carinata*, embracing all other existing birds, that agree in the possession of a keeled sternum. This initial step, however, is taken upon other grounds than the characters of the palatal, &c., bones alone; and its adoption may be found imperative. I am not prepared to offer anything upon the question, *Carinata* only falling within the scope of the present paper. These are divided into four orders, correspondently with as many main modifications of the bony palate, that only exceptionally merge into each other. *Dicholophus*, *Crax* (*gibbicera*) and *Picula* are the only intermediate forms known to the author. The two first may be regarded "as transitional between the Schizognathous and Desmognathous sections, or, at any rate, as approaching the latter division" (l. c., p. 455). The woodpeckers "are in fact not Desmognathous, the palate in these birds exhibiting rather a degradation and simplification of the Aegithognathous structure," (p. 468.) The fact then is unquestionable, that *Carinata* may be divided into four groups by certain characters, the value of

upon the question whether any other characters separate the Tinamous as widely from the *Rasores* with which they were associated, as the latter are separated from the birds of other orders; or, in a wider sense, are the Tinamous as different from all other *Carinatae* as any Schizognathous bird, e. g. a plover, gallinule or dove, is from any desmognathous bird, as a hawk, parrot or cuckoo? If not, an inequivalency of value between the sub-orders is implied, without any reference of course to their comparative extent. Aside from the fact that the Tinamous have "a completely struthious palate," it would probably be denied by none—not even by the author himself—that no characters can be found whereby to separate *Tinamus* from other *Gallinae* as a group of higher rank than a family: and further, that its peculiarities are of that kind or grade usually held throughout the ornithological system to be of family consequence.\* But if *Tinamus* can sustain an order *Dromognathæ*, the rest must follow. It is a fair test, apparently, of the real value of the basis of the system. Seeing that here the characters of the palate bones are at variance with all others, it is next to be inquired how far they agree with the indications of natural affinity, afforded in other instances by general characters.

The schizognathous structure obtains† in all *Rasores* (excl. *Tinamus*) in *Columbæ*, in most *Grallæ*, and about half of *Natatores*. The desmognathous prevails in other *Natatores*, in *Herodiones* of *Grallæ*, in all *Raptores*, and part of higher *Inscapores*, (not necessary to particularize here,) the rest of the latter being acgithognathous. If the palate characters are sure indices of affinity, the two large groups of *Grallæ* and *Natatores* must be dismissed as unnatural, and their components rearranged in two other series, each of which occurs a serial relation of families usually held to be widely separated, or, in some cases to represent nearly extremes of form. A corbeled or gannet comes next to the birds of prey, which only separate them from parrots. A goose is nearer to an eagle than to a gull. A pigeon comes nearer to a penguin or crane than to an insessorial bird. An albatross is more nearly related to a peacock than to a pelican. These, it is true, are among extreme instances; but the extremes as well as the means are a part of the system. In *Schizognathæ*, a sequence of groups is *Pallidæ*, *Laridæ*, *Spheniscidæ*, *Rasores*; in *Desmognathæ*, a sequence is *Herodiones*, *Columbæ*, *Raptores*. Discussion of these points is unneeded, as it would be merely a rehearsing of the principles that have hitherto guided all ornithologists in framing classifications. Here, characters of every sort are made subservient to one. The arrangement has the appearance—be it real or simulated—of a cryptogram, to which an arbitrary standard is the only key.

But ex parte statements do not do the subject justice; views for as well as against the system should be presented. Prof. Huxley considers *Charadriiformes* as a central group of Schizognaths, leading outward by three "distinct series or gradations." In one of these, *Otididæ* lead from plovers to cranes, and such genera as *Psophia* and *Rhinoceros*, thence to rails. In another, *Harporhynchus* is intermediate between plovers and *Gallinae*; whence *Syrhaptes* leads to pigeons. A third series begins with the gulls, leads through petrels to albatrosses and so to penguins: "the osteological resemblances between a plover, a gull, &c., being so close that it is utterly out of the question to regard these birds as members of different orders," (p. 455.) Conceding these series and relationships to exist, without reservation, still another point is easily raised. Passing from plovers to cranes and rails, in the manner indicated, the general affinities of some of the latter lead quite as naturally to certain Schizognaths, as herons and Totipalmates. I may instance *Heliornithidæ*, which I adopt as Brandt has shown, if osteology goes for any criterion, but

\*The *Arenaria* is apt to be the expression of the gallinaceous process towards, or tendency to, the struthious state with *Rallidæ*; i. e., a struthious phase of development or modification of the *Arenaria* idea.

†I have referred throughout to Prof. Huxley's paper for statements of facts respecting the characters.

related to Steganopods, at *Plotus*. From plovers again, a pure gallatorial form, *Recurvirostra*, shows transition at least as sure as others claimed to other palatine tiralia as *Ibis* and *Limicola*, and so to *Limellirostris*, of *Desmognathus*. In another series certain *Procellariidae* lead into desmognathous groups. *Ibis* has a lamellated bill, like that of a duck. *Heterodroma* has a gular pouch like the Steganopods; these last are directly allied to the herons by *Eulanius* and *Carcinus*. In many general features an albatross is like a pelican. Another Cœcomorph, *Colymbus*, is really totipalmate like all Dysporomorphs, the hallux being lateral and connected with the base of the second digit, even its hind toe as long as a cormorant's and the webbing increased *partim* it would be steganopodous. The relationships of the longest-winged Dysporomorph *Tachypetes* with the similarly constituted gulls and petrels will scarcely be denied. In an opposite direction the relations of some short-winged Cœcomorphs, as ducks and grebes, with similarly modified Dysporomorphs as cormorants and darters, will hardly be overlooked. Not to multiply examples of these transitions, in another direction than that according with the requirements of the system, it does not appear that the links by which Schizognathus and Desmognathus are joined to each other are weaker than those by which either of the two is held together, or so weak as those joining for example *Raptores* with Steganopods. And however the present argument may be invalidated by insufficient or unjust advocacy the above given broad facts of comparative degrees of relationships remain.

Since palatal modifications do not indicate groups of the taxonomic grade we have been considering it remains to enquire how far they avail in the construction of lower associations. No one will question how nearly Prof. Huxley's subdivisions agree with natural families, or orders, as the case may be. *Charadriomorphæ* correspond very nearly with that eminently natural assemblage of smaller tiralia, called *Limicola* or *Scolopacea*. *Cœcomorphæ* are a nearly *Fulicæ* or *Fulicæ*; with the addition of *Gruæ*, &c., which is perhaps much more naturally assigned them among the herons. Cœcomorphs comprehend both macropterus and brachypterus swimmers, but though this association may seem at first sight to be a little forced really it is not so. *Longipennis* and *Trimastix* come next each other in any system, and some forms actually inseparable, e.g. *Heterodroma* with *Mergulus*, *Puffinus* with *Colymbus* (tibial apophysis, &c.) *Spheniscomorphæ* are penguins alone—order *Podipæ* Bp., tribe *Nelipennis* s. *Imperialis* alior. *Spheniscus* antl. Testing Cœcomorphs at the point *Ileu imperialis*. *Accipitriformes* are *Gallina*, s. *Tinnimus*, and it is interesting, moreover, that the palatine bones allow separation of *Peristeromorphæ*. The unnatural nature of too intimate association of penguins with the true scratchers is bottle out by appeals to every character, it would seem. *Chenomorphæ* are precisely lamellirostra, or anatidæ. *Natæ* test group respecting the boundaries of which there is no dispute. The *Flamingo* goes as might have been anticipated are found to require Janus like division—*Amphimorphæ*, *Pelargomorphæ* are precisely *Heterodromæ*: *Dysporomorphæ* are exactly *Steganopodæ*. And so on.

Prof. Huxley has laid ornithologists under twofold obligations. First, he has pointed out in elaborate detail a certain character the value of which was not only unknown, but also unsuspected before, and has shown how perfectly it marks groups of a certain grade. Secondly, he has demonstrated once more—and it is to be hoped, for the last time—the futility of attempting to found such fundamental divisions upon any one single character.

What has gone before is possibly an estimate of the value and office of palatal structure not very different from what the general verdict of ornithologists will be. That the palatine bones afford nearly always correct indications up to certain point may be regarded as demonstrated by Prof. Huxley's researches. That they may be taken as the basis of the primary division of *Carnalia* will probably never be generally admitted. In ambiguous cases appeal to them may turn a nicely-balanced scale, and prove invaluable in limiting certain

[Dec

groups. But final appeal must not be made from all other characters to these; but from these—as one of many sets—as collateral testimony—to the total of the rest. As the sole basis for a system of ornithological classification, the scheme will probably remain in critical abeyance only until the time when its brilliancy shall have been forgotten, and its unsoundness alone be remembered.\*

Professor Lilljeborg's system† begins with the same three primary divisions that Nitzsch adopted after abandoning *Ratitæ*, and reducing them to an order of *Cursores*. Further, however, it differs materially and is in some respects unique. It is particularly to be observed of this system, that no single set of characters—no special theory—guided its formation. The author takes a general average of characters, and seeks to harmonize, as far as possible, conflicting views of such ornithologists as have been led to propose schemes based upon special investigations. Bonaparte's ideas respecting *Altrices* and *Præcoces*; Nitzsch's researches on the Carotids and Pterylosis; Sundevall's results regarding wing-coverts and flexor muscles of the feet; Cabanis' studies on the scutellation of the tarsus and other points; Muller's generalizations respecting the lower larynx; not to mention other data, have all been brought into use, judiciously estimated, and carefully coördinated. It is certainly the most 'catholic' system that has ever been proposed; there are intrinsic reasons why we might anticipate its high excellence.

Having already given some reasons for my belief that all carinate birds at least may be primarily divided into three groups, I need not repeat them, in assenting unreservedly to the way in which Professor Lilljeborg draws the lines dividing *Natatores*, *Cursores* and *Insessores*. There are a few ambiguous forms: *Phænicopteridæ* and *Heliornithidæ* are among them, coming between the first and second; some of the more terrestrial pigeons, or gallinaceous birds with barely elevated hind toe, may be others, coming between the second and the last. These may be noticed as well here as anywhere.

The Flamingoes are purely "grallatorial" in general conformation, but they are palmate, with duck-bill; and their internal structure is said to resemble that of *Anseres* more than Herons. Too much stress must not be laid upon the webbed feet, for some undoubted *Grallæ* are palmate, and all *Natatores* are not. The carotids show nothing, for they are exceptional in the class of birds. The balance is very even; there is perhaps no more purely transitional type. The palate bones would carry them near *Chenomorphæ*; the birds are said, also, to be præcocial, another indication to the same effect. But as the author takes the condition of the thigh and crus with reference to the body as a primary feature, he consequently assigns *Phænicopterus* to *Cursores*. *Heliornithidæ* are, has been said, pretty conclusively fulcarious; the author does not specially refer to them. Pigeons, usually placed in *Rasores* as a suborder, are here made an order of *Insessores*. They are palpable intermediate connecting forms; some terrestrial ones inosculating with *Rasores*, others, truly arboreal, as evidently coming under *Insessores*; a few are analogized if not actually affinized with *Accipitres*. Now it is characteristic of *Cursores* to walk on the ground;

---

\*I should remark that these paragraphs were written before I had seen any of the many criticisms that Prof. Huxley's article has called forth. I am more gratified than surprised to find how nearly the views of some authors for whom I entertain high respect agree with my own. I make no change whatever in consequence of what I have lately read; for though I might now be inclined to add considerably to the above, the appearance of the very articles in question has rendered unnecessary what more I should have to say.

A correspondent, whose name, were I authorized to use it in this connection, would be recognized as that of an eminent ornithologist, writes just now:—"Inasmuch as [this system] is based upon a single set of characters, it cannot be otherwise than arbitrary, and hence unsatisfactory. So far as the anatomical facts presented are concerned, it has some value; but the arrangement I deem to be on the whole far from a natural one. In short, I cannot regard it as other than a retrograde step, notwithstanding the excellent character of the author as a naturalist. It is, it seems to me, far inferior to others of a much earlier date."

† English reprint of original Swedish: P. Z. S., Jan. 1866.

of *Insectores* to hop. Pigeons are cursorial in that they (invariably I believe) walk: and other rasorial features need not be dwelt upon. They are also schizognathous, like *Ramores*. On the other hand, it is a fundamental characteristic of *Cursoria* to have the hallux elevated, though *Herodiones* are a single exception. This feature is not presented by the pigeons, which are moreover mostly as truly arboricole as the majority of *Insectores*. They are mostly *Altrices*, like the last. The balance appears in favor of their being *Insectores*, as the author holds them.

The Ostriches and affines are in this arrangement reduced to an order *Struthionnes* of *Cursoria*. *Archæopteryx* is not noticed, as may be said of other extinct forms.

Twelve orders succeed to the three sub-classes; agreeing in the main with divisions almost universally recognized, and defined in an unusually satisfactory manner. A notable point of difference between this and other systems lies in the tenth order, *Strisores*, which, as framed, does not largely accord with any previously established group. It is "a polymorphic group," as the author says, not easy to define by positive characters. An order *Zygodactyla*, equivalent to *Scansores* and retained; here, if anywhere, ulterior revision and decided modifications may be required. The zygodactyle birds appear to have so long had their place as a distinct order more because it has not been clear what to do with them if dismembered, than anything else. Toes in pairs is a thoroughly artificial character, as used; it is universally allowed that it unites birds otherwise widely dissimilar. It seems to be really only a modification to which any one family or genus of several groups is liable: if so its value has been largely overrated. It is most probable that the "order" *Scansores* or *Zygodactyla* will be broken up, in time, or at least restricted to some one of the types—perhaps the parrots,—now included under it: more fitting places being found for the cuckoos, trogons, toucans, woodpeckers, &c.

Regarding Prof. Lilljeborg's *Natatores*, I may express my conviction that the four orders he defines are the only natural ones, and that as such they must ultimately prevail. I only criticise the division of these four orders into two "groups," an intercalation between the subclass and the orders that is at least superfluous. Not that all the distinctions implied in the terms "*Simplirostres*" and "*Lamellirostres*" do not obtain; but that the groups are inequivalent. *Lamellirostres* are not more different from the *Simplirostres* than the several components of the latter are from each other. A goose, e. g., is not more different from a gannet than a penguin is. On this ground I hold the division to be unnatural as well as unnecessary. The two groups are further redundant, in that they have no analogues in other parts of Prof. Lilljeborg's natural system.

would be interesting to know whether they are altrices or præcoces, and how far the palate agrees with that of *Geranomorphæ*.

The "naturalness" of the division as a sub-class is sustained in a satisfactory if not conclusive manner, by the large number of types that *Natatores* include under natatorial modification; the open passages that lead from it to the other groups; the number of points where other groups infringe upon it; and especially the highly instructive way in which its four primary subdivisions repeat each other. I shall endeavor to point out the principal of each of these.

The passage from anserine swimmers to heron-like waders is so obviously through and by *Phænicopterus*, that the point need not be dwelt upon.

The passage from totipalmate swimmers to the same waders is unquestionably through the *Pelecanidæ* and *Cuncromidæ*. The affinities of *Balæniceps* and *Cancroma* among herons, with pelicans, have long been recognized and universally allowed.

The passage from urinatorial swimmers to certain of the *Grallæ* takes place from the point *Podicipidæ*, through *Heliornithidæ*, to fulicarious or paludicole waders, and from the same point through *Phalaropodidæ* to scolopacine or limicole waders. In each of these cases we have almost the only—if there be indeed any other—examples of the lobiped structure—a comparatively rare modification of the swimming foot. The phalaropes, besides being excellent swimmers, are further exceptional in their own sub-class in the texture of the plumage, which is completely duck-like.

The passage from longipennine swimmers to *Grallæ*, if not so evident, is nevertheless clear, in the osteological and pterylographic characters that are respectively more or less common to a gull, e. g., and the plover or snipe-like waders, as Nitzsch and Huxley have pointed out. Certain small petrels again, as *Oceanitis*, *Fregetta* and *Pelagodroma*, are exceptionally "grallatorial" in length of leg.

The waders coming next to swimmers, it is not to be expected that higher, i. e. rasorial, *Cursores*, still less a further removed sub-class, *Insessores*, should afford direct transitions; but as I shall endeavor to show, the swimmers give analogues to the main types of each of these sub-classes. Foreshadowing of the mammals in birds does not occur within the range of *Natatores*, unless the duck-like bill of *Ornithorhynchus* is a case in point. It really takes place at the point *Ratitæ*. It is among *Natatores*, as the lowest birds, that the counterfeit of another vertebrate type is found. The mocking analogy with fish is complete in the penguins.

The raptorial modification of *Natatores* is seen in the sub-family *Lestridinæ* of *Laridæ*. The habitus of these is that of land birds of prey—a universally recognized resemblance. In their food the Jaegers are vulturine. Physiological analogy is borne out by physical characters. Jaegers are the only cered swimmers, as Accipitres are the principal cered perchers. The claws of *Lestridinæ* are more "raptorial" than those of any other swimmers. A singular rugosity of the tarsi is shared by the Jaegers and the most aquatic genus of Accipitres—*Pandion*.

The rasorial modification occurs in urinatorial swimmers. All these have short, more or less concave, wings that are rapidly vibrated, and fly with great impetus; very gallinaceous features. Some *Alcidæ* employ the characteristic habit of *Gallinæ* in constructing their nests; rasorial has developed into fossorial. Other auks, notably Phalaridines, instantly recall quails by their general aspect; a species has been named from the circumstance. The bill of *Mergulus* repeats a partridge's. Absence of the hallux that marks all *Alcidæ*, though sufficiently frequent in scolopaceous *Cursores*, is rare among the alectoromorph *Cursores*; yet it characterizes a family—*Turnicidæ*. One of the rarest modifications, viz., abortion of rectrices, that marks a family of *Urinatores*, is only again found in some representatives of a rasorial family—*Crypturidæ*.

Tubular nostrils are not a very common feature. It is the prime characteris-

1869.]

one whole family—*Podicipidae*; in all others rectrices occur. A small, definite number of rectrices may be observed to be in inverse ratio to the size of the tail as a whole. The number is ordinarily 12, in those forms with well-developed tail; as in all *Laridae*, most *Procellariidae*, most *Phalacrocoracidae*, the genus *Plutus*. A few Petrels, as some of the little *Procellaria* proper (*Thalassidroma* auct.) are said to have only 10; the statement requires confirmation; most of them, as *Cymnchores*, *mlhi*, and *Oceanites* K. and B., have 12. Many larger Petrels, as *Fulmarus*, *Daption*, &c., have 14; *Omnifraga gigantea* has 16. Among Cormorants the number of rectrices seems to be scarcely generic; some species having 12, others 14. As a rule *Alcidae* have definitely 13 rectrices. *A. impennis* is said to have 18. *I'hagithon* has 16. *Sulidae* have 12 and 14. *Tachypetes* has 13. Other genera included in the *Spheniscidae*, *Colymbidae*, *Pelecanidae* and *Anatidae* have a number varying from 12 to 32, though rarely over 24, and in instances where the larger numbers are approached or reached the tail may have an odd number, as 21, 23.\* Not taking into account the small, short, rounded tails above mentioned as "typical," the *Notatores* furnish great variations in shape of the tail as a whole. It may be long and deeply forked, with more or less filamentous rectrices, as in nearly all *Sterninae*, some *Larinae*, the *Rhynchopinae*, and more particularly the *Tachypetidae*. It is large and square in most *Larinae*; of corresponding size, and more rounded, or even approaching a wedge-shape, in many *Procellariidae*. It is moderate or rather large and cuneate, in one gull, *Rhodostethia rosea*, and one Petrel, *Haliastur microsomus*. In certain terns (*Anous*) it is both forked and cuneate, i. e., lateral feathers graduated, central pair shorter than the next. It is short and cuneate in some ducks, and in *Spheniscidae*; certain of the latter, however, have much better developed tail, with fewer rectrices, than others. The tail is long, broad, and fan-shaped in *Plutidae* and *Phalacrocoracidae*, where, moreover, the rectrices are exceptionally stiff. Finally, a few swimmers have curiously modified central rectrices. Thus in *Harelda glacialis* these are long-exserted and filamentous; a condition exaggerated in most *Leucostictidae* and carried to an extreme in *I'hagithontidae*.

There are few other modifications of the feathery covering that require notice. Some swimmers are ornamented with singularly modified feathers, chiefly about the head. Many *Spheniscidae*, and most *Alcidae*, especially phalaridine forms, have curiously colored and shaped crests. Nearly if not all *Podicipidae* are instructed with conspicuous ruffs of long, loose feathers; when these are deficient, as in *Podilymbus*, stiff bristles occur. The bars of stripes on the neck of *Colymbidae* are of keel-shaped feathers. Cormorants have colored filoplumes about the head; other, perhaps similar, patches are found

may be observed. In the highest forms, as *Anatidæ*, the feet are brought under the centre of equilibrium, and the body is consequently supported with its long axis horizontal. Some Steganopods—the next order—have much the same condition; in others, as Cormorants, the legs are much further back, and the body must be held almost upright. Most *Longipennes* are like *Anatidæ* in this respect, but here *Halodrominæ* offer almost the other extreme. In Pygopodous families the maximum of backward position of the legs and upright position of body is attained. A few or several *Alcidæ* stand and walk tolerably well, but all *Colymbidæ*, *Podicipidæ* and *Spheniscidæ* must rest nearly upright on the rump, and progress on land with extreme difficulty. Burial of the thighs and more or less of the crura in the skin of the body is ordinarily in direct ratio to backward position of the legs, and in inverse proportion to ease of walking. Nevertheless, some good walkers, as geese, have less free legs than certain small petrels that scarcely walk. As a rule, utility of the feet as pedestals and as paddles is directly complementary. The most adroit and untiring swimmers, and those that progress under as well as on the water with ease, are the poorest walkers. Compare a goose with a loon, *e. g.* In one order, Steganopods, we have the fact illustrated in contiguous families: pelicans do not follow their prey under water; cormorants do; there is a precisely corresponding angle of inclination of the body in each case. To avoid interference of the broad-webbed feet the legs are widely separated; a divarication begins in the axis of the femur, and is increased in other segments. Hence the characteristic “waddle” of ducks, &c.; their gait, compared with that of true walkers, corresponds somewhat to the difference that may be observed in the sexes of our own species, arising from difference in width of pelvis. There are many other interesting items in the construction of a perfect pair of paddles, too numerous to note here. A loon's legs may be taken as the type. Some time ago I worked out all the details, as seemed to me, in this case, and may be permitted to give the reference, in place of further observations.\*

The tarsus most commonly presents no special noteworthy features. Occasionally it is extremely compressed, as among loons and grebes. Its horny covering has nothing of the importance that attaches to it among *Oscines*, for example, though the two primary types of reticulation and scutellation sometimes mark natural groups, as geese as distinguished from ducks. The tarsal envelope is fused in one genus.

The toes may be three or four: if the former, it is always the hallux that aborts. All have the normal number of phalanges, the relative lengths of which usually, if not always, conform to a general rule. In comparative length as wholes the hallux is always shortest; the others usually run 2d, 4th, 3d in length, but not rarely 2d, 3d, 4th. There is often only a very slight inequality in the 3d and 4th, exactly compensated by complementary difference in length of claw, so that the claw-tips fall together, *e. g.* many *Procellariidæ*. The hallux, as a rule, is present; its absence or rudimentary condition marks one whole family, *Alcidæ*, two sub-families, *Diomedeinæ* and *Halodrominæ*, of *Procellariidæ*, and one species of one genus (*Rissa tridactyla*†) of

\*Zoology, &c., of *Colymbus torquatus*, Mem. Bost. Soc. Nat. Hist., I, pt. II, Nov., 1866, p. 131.

†Examining a great many *Rissa* from the North Pacific, I have found a hitherto unsuspected and probably unsuspected state of things. There are in that region two perfectly distinct species of Kittiwake. One is *Rissa brachyrhyncha*, (Gould, (= *R. brevirostris*, Brandt.) with red or yellow legs, yellow bill, &c., &c. This has a very small hallux; but still retaining a minute claw, that looks like a little black speck on the extremity of the toe. The other is the *R. kotzebui*, Bonaparte, or at any rate the bird I identified and described under that name some years since. Bonaparte's diagnosis is simply “hallux magis retracta.” Now this form is identical with and not distinguished from *R. tridactyla*, except by the hind toe. The hallux is almost always larger and better formed; and the claw is in a state scarcely or not different from that of *R. tridactyla*, up to a perfectly perfect condition, claw and all. In some specimens the hind toe and claw are as large, and as strongly developed, as those of any *Larus* I ever saw! The distinctive feature of the genus *Rissa* thus appears to be constant. What makes the North Pacific Kittiwakes vary thus, while the Atlantic ones are constant, as far as known?

*Ardeidae*. In the other subfamilies of *Procellariidae* it is scarcely more than an immaterial toe-claw. When present, its cost is variable. Without exception, it is raised above the level of the anterior digits; but the elevation is slight in the *Tropicidae*, among which are found the most arctic and alpine swimmers, just as in *Ardeidae*, of *Ciconiidae* which are pretty good perchers. Its direction is ordinarily straight backward, to which the best exception is seen in the oblique inward position in all *Scolopacidae*, where, likewise, this toe is much longer than elsewhere. In *Sphenocoridae* the hallux is very small, lateral and elevated. As to its connection with the other toes or the tarsus, we find several modifications. In the first place we have the condition in *Procellariidae* of sessile immobility. Next a lengthening and freeing, as in *Larus* and *Fulmar*. Then with slight increase, or none, in length, there may be a broad membranous lobe depending from it, e. g., *Fuligulidae*, *Pelecanidae*. This lobe, again, may unite it at base with the tarsus or inner toe, as in *Colymbidae*: a condition intermediate between the foregoing modification and the only other one to be noticed, viz., that characterizing the *Scolopacidae*, when the very long hind toe competes, by webbing to the claws with the inner one, the totipalmate foot. In most or all those cases where the hallux aborts, I think its accessory metatarsal is still to be found beneath the skin of the tarso-metatarsus. I have never sought for it in vain.\*

Palmation is undoubtedly the prime characteristic of the swimming foot: yet it does not always obtain. Lobation marks one whole family (the Grebes). But in *Podilymbus*, at least, there is a sort of compromise between the two styles: the toes being perfectly lobed, yet webbed at base. More or less imperfection of the webs in truly palmate forms exceptionally occurs. *Hydrochelidon flabipes*, e. g., has the webs so deeply incised that it is scarcely more palmate than such grallatorial genera as *Symphemus*, *Ereunetes*, &c. Some Anserine genera are defective in this respect. But ordinarily the free margin of the two or three webs departs but little (and that in concavity) from a straight line between the ends of the toes; it is sometimes a little convex.

The claws as a rule offer nothing of importance. They are small, short, stout, little curved, not very acute. One or two genera of *Alcidae* have a claw on the second toe differing in all these respects from the others; it is ordinarily, also, laid flat, not upright. Rarely the middle claw is dilated and pectinated (*Tachypetes*); as in Herons, Goat-suckers, &c. The Grebes offer exceptional claws; these are broad, flat, and squarish in shape, much like human nails. *Rissa tridactyla* offers perhaps the only instance of a toe without a well formed claw.

The bill of *Natatores* is so variable in all its features that it is best consid-

Southern, and essentially Antarctic. Nearly all *Natatores* are either largely migratory, or else are widely wandering pelagic birds.

*Subdivisions of the Subclass.\**

Assembled in such variety of character, swimmers may be easily and conveniently divided in several ways, according to the standard taken. But I presume only one of these can be the right (*i. e.* the natural) way; and further, that *cæteris paribus*, the scheme that takes into consideration the greatest number of characters will come nearer the truth than one that proceeds upon isolated grounds. A *sine quâ non* of any scheme must be equivalency of value of the groups to which the same taxonomic rank is accorded.

There is no safe stepping-stone between the subclass and its orders. There are four orders, *i. e.*, four modes of expression of the Natatorial plan or idea. In the following definitions of these, diagnostic or more important characters are italicized:—

Ord. I. PYGOPODES.—*Legs posterior, horizontal position of axis of body impossible: most of crus as well as femur buried. Brachypterous; wings short, never reaching end of very short, many-feathered tail, that is sometimes wanting. Body depressed. Feet tetra- or tri-dactyle, lobate or palmate, never totipalmate: hallux elevated, functional or not. Bill not lamellate nor serrate; wholly corneous, entire. Nostrils lateral, mostly basal, well formed, never tubular. No gular pouch. Tibia often with a long apophysis. Carotids single or double. Schizognathous. Altrical or Precocial. Scarcely ambulatorial; sometimes not flying at all; urinatorial; swim under as well as on the water; lie deep on the water. Heavy, clumsy on land. Natatorial Natatores.*

Ord. II. LONGIPENNES — *Legs near centre of equilibrium, horizontal position of body usual. Femur buried; crus largely (or wholly?) free. Macropterous; wings long, pointed, surpassing the base, and often the tip, of the large well formed few-feathered tail. Feet tetra- or tri-dactyle; always palmate, never totipalmate; hallux, when present, free, elevated, very short, functionless. Bill wholly corneous, entire or pieced, unguiculate or not, never laminate (exc. *Prion*, &c.) nor serrate. Nostrils variously, but always well-formed, lateral or superior. None, or only a rudimentary gular pouch. Tibia with or without apophysis. Carotids double. Schizognathous. Altrices. The majority ambulatorial; all highly volucral; none urinatorial; all rest shallow and swim easily on the water. Light, elegant in all three elements.† Volucral Natatores.*

Ord. III. STEGANOPODES.—Position of legs variable; generally well posterior, but sometimes approaching the preceding. Wings variable, but generally long and pointed, approaching or equaling the preceding. Tail variable, sometimes short and indefinitely feathered, usually long and few-feathered; cuneate

\* Reduce to an order, and *pari passu* reduce the value of subordinate groups, if *Saurura*, *Batida* and *Carinata* be accepted as sub-classes.

With such reduction in value, *Insectores*, *Cursorres* and *Natatores* would become "orders" of *Carinata*, and the four "orders" indicated below would be suborders or "tribes,"—*i. e.*, simply collocations of families. Throughout this article I call *Natatores* a "sub-class" in a conventional sense only, as indicating one of the first divisions of a class *Aves*, as usually held.

Even with this depreciation in the scale, I do not suppose that the Avian groups have the value of those of the same name in other classes of vertebrates. Birds adhere so closely to a common type, that the extremes of difference in form found among them rarely seem to indicate divisions of a higher grade than those marking orders in lower vertebrates; in fact, it is a question whether *Aves* as a whole are more different from some other vertebrates than certain (*e. g.* reptilian) "orders" are from each other. But, however variously vertebrates may be primarily divided (as into *Hemalotherma* and *Hemato-*  
*therma*, into *Icthyopsida*, *Sauropsida*, &c., &c.), the four "classes" of *Pisces*, *Reptilia*, *Aves* and *Mammalia* will probably always endure, and be virtually our taxonomically equivalent points of departure for further divisions. Therefore, as it seems to me, the rank of *Natatores* only hinges upon the question of *Carinata*, &c., as the primary divisions of *Aves*.

† To most of these characters *Haliastur* is a signal exception. But its tubular nostrils define its position.

forked, rounded, or fan-shaped. Feet always tetra-dactyle, *totipalmate*, *hallux depressed, lateral, long, functional*. Bill wholly corneous, never lamellate; *tomia serrate* or not; its covering continuous or not, with or without a nail; *external nares very small or abortive*. A *gular pouch*. Tibia simple. Carotids double. *Desmognathous*. *Altrices*. Ambulatorial, or scarcely so; generally powerful flyers; often good perchers; urinatorial or not. Heavy, if not clumsy on land. *Insectorial Natatores*.

Ord IV. LAMELLIROSTRES.—Legs, as in *Longipennes*, near centre of equilibrium; position of axis of body in walking horizontal. Wings constant, moderate, reaching to, but not beyond, the short rounded (exceptionally long cuneate) many-feathered tail. Feet always tetradactyle, and palmate; never *totipalmate*; hallux elevated, moderate, free, simple or lobed, probably functional in all cases. Bill lamellate, but *tomia* not serrate, covered with soft skin in greater part, with more or less distinct nail at tip. Nostrils constant, well formed, latero-superior, subbasal or median. No *gular pouch*. Tibia simple. Two carotids. *Desmognathous*. *Præcoces*. Highly ambulatorial; good flyers; excellent swimmers; poor divers. Heavy, though not clumsy, in either element. *Cursorial Natatores*.

The sequence of these orders is fixed. *Pygopodes* are first or lowest; *Lamellirostres* last or highest, beyond question. It might seem, on several accounts, particularly position of legs, that *Steganopodes* should come next to *Pygopodes*. But we cannot put anything between *Longipennes* and *Pygopodes*, for they touch if not *mosculate* at the points *Halodroma* and *Mergulus*. Moreover, other *Procellarudæ* have the long tibial apophysis that characterizes divers, but disappears higher in the series.

#### Families and subfamilies of PYGOPODES.

The Penguins might be considered as presenting differences of more than family grade; they have been made a tribe or suborder (*Impennes*, *Nultipennes*, *Squamipennes*, *Ptilopteri*, auctt.) Thus they are unique in possessing no remiges, scaly feathers, not entirely connate metatarsals, flat pterygoids and arm-bones, and peculiar elbow-joint,\* not to mention other lesser features. But their characters are mostly of degree, not of kind; and above all, the link between them and *Alcidæ* is so close and complete by *Alca impennis*, (extending even to elbow joint and metatarsals) that the differences are really not so great as appears at first sight.

Three other families are not open to question. The four are thus distinguished, by external characters alone:

For. Desmognathous. Feathers scaly. No remiges; wing: useless for flight.

species. The genera are numerous; all apparently safely grounded. It is rather difficult to group them satisfactorily into subfamilies; but there do seem to be three series of genera, the components of each of which are decidedly more intimately correlated with each other than with any of the genera of either of the other two series. We have therefore three subfamilies, as follows:—

Subfam. *Alcinæ*.—Ptilosis reaching to or beyond linear nostrils; no crests; tail cuneate; bill sulcate, cultriform. Typical “Auks;” connecting with Penguins. Genera: *Alca*, *Utania*.

Subfam. *Phaleridinæ*.—Ptilosis not reaching various nostrils; mostly crested; bill various, but always compressed, somewhat cultriform, often appendaged; tail squarish or rounded. A middle group, leading nowhere; sometimes under a quail-like mask. Genera: *Fratercula*, *Lunda*, *Ceratorhyncha*, *Sagmatorrhina*, *Smorhynchus*, *Ptychorhamphus*; the first named nearest *Utania*, the last next to *Mergulus*.

Subfam. *Uriinæ*.—Ptilosis reaching to linear or rounded nostrils; bill conic or subcylindric, simple, usually much elongated; tail rounded or pointed; head not crested (exc. one species). “Guillemots.” Genera: *Mergulus*, *Synaliborhamphus*, *Uria*, *Lomvia*. The last named repeating *Alcinæ* in coloration; grading towards *Colymbidæ* in the char. of bill. The first (*Mergulus*) in quail-guise; and forming the inosculating point of the present order with *Longipennes* by means of *Halodroma*.

Fam. COLYMBIDÆ.—Plumage normal. Ptilosis reaching nostrils. Hallux well formed, semi-lateral, joined to base of inner toe. Wings pointed. Feet palmate; fourth digit lengthened. Tarsi flat, reticulate, their posterior edge smooth. No crests. Lores feathered. Tail short, but well formed. Bill constant, long-conico-compressed, simple. Nostrils linear, lobed. Claws narrow.

A small family, of (technically) one subfamily and only one genus, *Colymbus*, with some half-dozen species. Related to auks through *Lomvia*. Representing, by its quasi-totipalmate feet, the *Steganopods* among *Pygopodes*! But affinities really closest with the next family.

Fam. PODICIPIDÆ.—Plumage normal. Ptilosis not reaching nostrils; lores naked. Nostrils lanceolate, &c., not lobed. Wing rounded. Hallux well formed, lobed. Feet lobate, or lobate-semipalmate. Tarsi flat, their posterior edge serrate. Conspicuous crests, or modified feathers about head. Tail rudimentary. Bill simple, variable, stout or slender, conico-compressed, long or short. Claws subquadrate, flat.

A family unique among water birds in its single carotid, lobed feet, abortive tail, and flat nails. Nearest *Colymbidæ* in affinity; replacing, in its subclass, fulicarious *Grallæ*,—in fact, linked therewith by *Heliornithidæ*. Counterfeiting some *Crypturidæ*, of gallinaceous birds. Its longest-billed and -beaked genus representing in its own family the place of *Plotus* among *Steganopods*.

But one subfamily is usually recognized. There may be two, for one genus differs more from the rest than any of the latter do from each other. The following would be the diagnoses, but I scarcely think it necessary to make this distinction with such little difference:

Subfam. *Podilymbinæ*.—Bill stout, almost hooked. Nostrils sub-circular. Lores broadly naked. Frontal feathers bristly; no decided crests. Tarsus not three-fourths of the middle toe. Feet semipalmate, as well as lobed; hallux narrowly lobed. Genus: *Podilymbus*.

Subfam. *Podicipinæ*.—Bill slender, straight at tip. Nostrils linear. Lores narrowly naked. Frontal feathers simple; usually conspicuous crests and ruffs. Tarsus three-fourths or more of the middle toe. Feet with only a small basal web in addition to the lobes; hallux broadly lobed. Genera:

1869.]

*Echmophorus*, *Podiceps*, *Sylbeocyclus*; possibly one or two others, but most of the genera invented or used by Kaup, Bonaparte, and others, are untenable, representing only specific characters. *Sylbeocyclus* (type *S. minor*) is the connecting link between the two subfamilies.

*Families and subfamilies of LONGIPENNES.*

There are but two families of macropterous swimmers, that moreover shade into each other so insensibly and completely that the condition of the nostrils is sometimes almost the only character. Thus *Thalasseica glacialis* is a pure gull, even to colors, with tubular nostrils. In fact, I know of no positive unqualified character but this that will reach through the whole of the two families as a distinguishing mark. Still there are others of greater or less significance. Both the families are clearly differentiated into several subfamilies, which are much easier to define.

Fam. PROCELLARIIDÆ.—Nostrils tubular, lateral or superior, united or separate. Bill variable in shape, always hooked; its corneous envelope (always?) in several pieces; rarely laminate. Wings long and pointed (one exc.) Tail variable in shape; usually small, never very long, of 12—16 (rarely 10??) rectrices, of which the central are never suddenly long-exserted. Feet palmate; hallux present, minute, functionless, or absent. Tarsal envelope sometimes continuous (a unique feature among swimmers!). Truly pelagic birds, independent of land. Altrices.

Three strongly marked subfamilies, thus:

Subfam *Diomedæ*.—Nostrils lateral, disjointed, horizontal. Feet tridactyle. Wings extreme, in length of humerus and ulna, and with highest number of remiges (fifty) known among birds, but only ten primaries, as usual. Genera: *Diomedea*, *Phœbetria*, founded on sulcation of mandible and shape of tail.

The albatrosses, in size, contour, and length of wing, repeat the *Pelecanidæ* in their own family; in length of wing they are only otherwise approached by another Steganopod family,—*Tachypetidæ*. But still a constricted group, with no aberrant forms.

Subfam *Procellariinæ*—Nostrils superior, horizontal, united in one double-barrelled tube. Too various in other respects to be concisely characterized. Still, the central or typical aspect of the family; throwing out feelers in several directions.

One group comprises the smallest species, with pointed wings, elastic flexible primaries, rather long tail, variable in shape; the most slender and longest legs of the family. These birds are pelagic *Cypselidæ*. Genera *Oceanodroma*, *Cymochorea*,—*Tomastodroma*, *Hydrobia*, *Hydrochelidon*, *Hydrochelidon*.

A fourth group is represented by three genera, *Estrelata*, *Pagodroma* and *Daption*, each distinctly characterized. The two last are unispecific. In the first I throw the very many species agreeing in medium size, strong largely-hooked bill, long wedge-shaped tail, and rather short wings. Its species have received a dozen, more or less, generic names. There are about a score of them. *Daption* is peculiar in its wide bill, with rudimentary lamellæ and quasi-gular pouch, indicating Anseres and Steganopods. *Pagodroma* is among petrels much what *Gygis* is among terns, and *Pagophila* among gulls.

The last group, called *Prionæ*, is remarkably distinguished by the lamination of the bill, equal, in one genus, to that of *Lamellirostres*, and only here found outside that order. There is also a shape of bill in *Prion* corresponding to *Coneroma* among Herons! and the throat is somewhat pouched. One square-tailed, light-colored form *Halobæna* recalls the Gulls. Genera: *Halobæna*, *Pseud-prion* *Prion*.

Subfam. *Halodrominæ*.—Nostrils superior, vertical, united, on the culmen at base. Mandibular space wide, with a distensible skin. Feet tridactyle. Wings and tail, and general form, of *Alcidæ*! Genus: *Pelecanoides* (Lacép., about 1801: = *Halodroma*, Ill. 1811, et auctt.)

A singularly aberrant form, only Procellariidian in the nostrils: standing at a point where *Longipennes*, *Steganopodes* and *Pygopodes* meet: Steganopodous in its dilatate throat, &c.; Pygopodous in feet, wings and tail. It is almost a *Megapoda*.

Fam. LARIDÆ.—Bill generally with continuous covering. Nostrils always lateral, linear, or lance-linear. Wings always long and pointed, reaching far beyond base of tail. Tail always well developed, definitely few-feathered (12 rectrices, but of varying shape. Feet always tetradactyle: hallux small, simple, elevated, apparently never functional. Strong dashing flyers, good light swimmers, poor divers. Altrices.

A definitely circumscribed group, without any remarkably aberrant forms. Sharply divided by characters of bill, &c., into four subfamilies, thus:—

Subfam. *Lestridinæ*.—Covering of bill not continuous: upper mandible intersected with a distinct cere; bill epignathous.\* Tail squarish, but median rectrix as abruptly long-exserted. Head never crested. Tarsi rugose: feet anisodactyl. Genera: *Buphagus*,† *Stercorarius*†

Comprehending the "Jaegers," or "Skua Gulls." Affording the only examples in the subclass of a cered bill. In this partition of the rostral envelope we have an interesting approach to an essential character of the pterodactyl group—an affinity borne out by the pterylosis. For, says Nitzsch in the *Proterodactylæ*—the tract formation of *Lestris* is elevated into the type of a group. The peculiar construction of the tail is only elsewhere met with among water birds, in the Anserine genus *Harelda* and the Steganopodous *Pseud-prion*. The Jaegers are marine Accipitres!

\*There are only four possible conditions of the bill, with reference to the relation of the two mandibles to each other. (1) the upper mandible overreaches the lower, and is reflected over it; (2) the under mandible extends beyond the upper; (3) the two meet exactly; (4) the points of the mandibles cross each other. I propose to call these four types *epignathous*, *hypognathous*, *paragnathous* and *metagnathous* respectively. The first is exhibited by all the *Raptores*, *Pittari*, *Procellariidæ*, &c., &c. The second is exhibited by the *Buphagines*. The majority of birds, especially *Proseres*, exhibit the third. Of the fourth I only know one instance,—the Cross-bills (*Curruca* Scop. = *Loxia* Linn.). To form a *Lestris* is the only one that comprehends examples of three of these forms: and therefore are, as we have seen, almost diagnostic of the subfamily.

†In respect of the epignathous type, it should be noted that to constitute this form the cere should affect the premaxillary itself, and be perceptible in the skeleton, in the form of a point or margin of the corneous envelope of the bill, not sufficient to form a *caput* are paragnathous.

The singular bird, the *Anarhynchus*, might be thought to represent a fifth kind, but I believe it to be paragnathous. The modification in this case is of a different kind than that of the species of bilateral asymmetry, like the bent vomer of certain species.

†Macleay's and Brisson's genera cannot obtain, we must take *Catharista*, Brisson, type *A. leucæ*, and *Lestris*, Ill., type *L. parasitica*, Linn.

Subfam. *Larinae*.—Covering of bill continuous; bill epignathous. Tail usually squarish; rarely forked or wedged. Head never crested. Hallux in one species imperfect. Tarsi almost always smooth. Feet ambulatorial. Genera: *Larus* (possibly with a few divisions), *Rissa*, *Pagophila*, *Chræcocephalus*, *Rhodostethus*, *Xema*, *Oreagrus*.

The central group of the family: all the genera closely related. Distinct, on the one hand, from *Lestridinae*, but on the other shading into *Sterninae*, through the smaller, hooded, forked-tailed, &c., species, the bill of which insensibly passes into the tern-like form. Altogether too many genera have been invented, not discovered, in the genus *Larus*. I would unite under this name all the large square-tailed, unhooded forms, of whatever color, doing away with *Blanius*, *Adelarus*, &c., not to mention a number of worthless "coups," as M. Temminck would justly call them. *Rissa* is different in its feet, at least in the type of the genus. *Pagophila* is well marked in several respects; it corresponds to *Gygis* among Terns, and *Pagodroma* among Petrels. *Chræcocephalus* may well embrace all the smaller square-tailed "hooded" Gulls; these go into the tern-like shape of bill. The other genera above named are based mainly upon shape of tail.

Subfam. *Sterninae*.—Covering of bill continuous. Bill paragnathous. Wings extremely long and pointed. Tail generally long; commonly forked, but of other shapes. Hallux constant. Tarsi smoothish; feet small, scarcely ambulatorial. Head often crested; sometimes singularly so. Genera: *Gelochelidon*, *Thalasseus*, *Phætusa*, *Sterna*, *Hydrochelidon*, *Haliplana*, *Anous*, *Inca*, *Gygis*.

Adhering well to a recognizable type, but varying in details of form, whence the numerous genera. *Gelochelidon* is gull-like, especially in bill. *Thalasseus* comprises the largest robust species, with a soft, flowing occipital crest. *Phætusa* has large southern species with great turgid bill. *Sterna* is central, with many deeply-forked tailed species like *hirundo*, &c. *Hydrochelidon* is singularly fissiped, from defect of webs. *Haliplana* is nearly *Sterna*, but with different bill, feet and coloration. *Anous* is a singular form, with a long forked-graduated tail; i. e., central feathers shorter than next, others again graduated. *Inca* comes near it, but has unique, curly plumes on the side of the head, as in the Cormorants, and especially some Auks! *Gygis* is the Tern expression of the idea of the Gull *Pagophila* and the Petrel *Pagodroma*. The Terns are marine *Hirundinidae*!

Subfam. *Rhynchopinae*.—Bill cultrate, hypognathous; otherwise as in the preceding subfamily. Genus *Rhynchops*.

The single genus is a Tern in everything but the anomalous bill. The light-colored internal structure of the tined part of the upper mandible

a scattering group. And in general among birds, the closer the inter relation of forms included in a group of any grade, the more definitely circumscribed is that group from its surroundings; and conversely.

**Fam. SULIDÆ.**—Bill very short, serrate, decurved at tip, but not hooked with a distinct nail; its covering continuous. Nostrils abortive. Gular sac undeveloped. Wings mediocre. Tail large, cuneate, definitely few (12—14)-feathered. Head not crested. Feet ambulatorial. Body with remarkable pneumaticity; not much depressed. Taken from\* Geese. Technically one sub-family. Genus: *Sula*; perhaps another sufficiently distinct.

Evidently anserine in form and general appearance, as well as many details. The serrated simulates the lamellated bill. The wings are like a goose's; the tail of few feathers repeats that of some *Anatidæ*; the feet are strongly ambulatorial.

**Fam. PELECANIDÆ.**—Bill very long, slender, but strong; its covering not continuous; not serrate; distinctly hooked with a nail. Nostrils rudimentary. Gular sac at a maximum. Wings extremely long, with upwards of forty remiges. Tail short, rounded, indefinitely many-feathered. Head crested. Legs columnar, very stout. Body with unusual pneumaticity; moderately depressed. Taken from Albatrosses. Technically one subfamily. Genus: *Pelecanus*; perhaps another.

The immense, many-feathered wings, and the size and general appearance of these birds, recall the Albatrosses. So does the hamulate, broken-covered, non-serrate bill. Progression in either of the three elements is similar; neither of the birds can swim under water. The enormous pouch represents the extreme of development in the order. Yet some of the family to which Albatrosses belong have it; witness the genus *Pelecanoides*.

**Fam. PHALACROCORACIDÆ.**—Bill mediocre in length, rather slender, strongly hamulate, non-serrate, but its covering scarcely broken. Nostrils obliterated, at least in the adult state. Gular sac moderate. Wings short or medium. Tail large, fan-shaped, very stiff, definitely few (12—14) feathered. Head with curiously modified feathers. Legs far back, not ambulatorial; upright position necessitated. Pneumaticity slight. Body greatly depressed. Heavy flyers; excellent divers. Taken from Auks. Technically one subfamily. Genus: *Phalacrocorax*; but probably capable of well-founded divisions.

These are palpably pygopodous; representing the extreme, in this respect, of the present order. They are forced to stand upright, and use the tail as additional support. They progress under water better than any other totipalmate birds, except the *Plotidæ*. The curious colored feathers about the head are those of Auks and Penguins. By remote analogy, there is a resemblance to *Scansores*.

**Fam. PLOTIDÆ.**—Bill very slender, straight, not hooked, sharply paragnathous, subserrate, its covering continuous. Nostrils minute. Gular sac small. Wing short. Tail large, fan-shaped, 12-feathered. Legs far back; used on land chiefly in perching; position more or less upright. Pneumaticity ordinary. Body depressed. Poor flyers; unsurpassed divers. Taken from Grebes. Technically one subfamily. Genus: *Plotus*.

The analogy, if not actual affinity, is very striking in this case. Physically, the long neck, style of bill, shape of wings and position of feet, are like the same parts in *Podicipidæ*. Physiologically the Darters share with the Grebes a habit almost confined to these two families: that of sinking back quietly in the water, leaving only the bill exposed. Both are unrivalled divers. Moreover, we have in that singular family, the *Heliornithidæ*, an actual link between Grebes and Darters; further carried to fulicarious forms.

---

\* Not actually, of course, but potentially, or ideally.

Fam. TACHYPETIDÆ.—Bill rather long, stout, strongly hooked, its covering not continuous. Nostrils very small. Gular sac highly developed.\* Wings and tail excessively long and strong; the latter deeply forked, 12-feathered. Legs extraordinarily† short, well forward, but scarcely used. Tarsi plumose; middle claw pectinated. Unsurpassed flyers; scarcely swimmers; not divers. Taken from Petrels. Technically one subfamily. Genus: *Tachypetes*.

The tarsal ptilosis, and pectination of the middle claw, are unique in the subclass; the webs are more deeply incised than usual. In wings, tail and bill these birds are modified Petrels.

Fam. PHAETHONIDÆ.—Bill medium, stout, straight, sub-serrate, paragnathous, its covering continuous. Nostrils small, but pervious. Gular sac smallest in the order; wholly feathered. Wings long and pointed. Tail moderate, but with long-exserted, filamentous median rectrices; 16-feathered. Feet well forward, short and stout; horizontal position of body necessitated. Excellent flyers, good swimmers; not divers. Taken from Terns. Technically one subfamily. Genus: *Phaëthon*.

The gular sac is scarcely more than rudimentary, and it is fully feathered; the nostrils are comparatively well developed. The bill is almost exactly that of a Tern. The filamentous tail feathers are rarely found outside *Sterninæ*. The general resemblance to a Tern, in physical characters, as well as mode of life, is too obvious to require further comment.

So we see that each main group of water birds has been laid under contribution to form this scattering polymorphic family, a comprehensive mask for the rest.

#### *Family and subfamilies of LAMELLIROSTRES.*

A completely circumscribed group, of only one family, *Anatidæ*, whose characters are those of its order. The only break in the family is at the point of departure from *Natatores* to *Grallatores*, where the way is opened for the passage from *Anatidæ* by *Phalacropterus*. There are six subfamilies, just as there are six families of the preceding order. These are mainly distinguished by the varying combination of characters common to several; but some introduce peculiar features. Of the latter, *Merginæ* are the furthest removed, perhaps, from all the rest. They have consequently been considered by some as a separate family. But a merganser is scarcely or not more different from a duck than a swan is. Regard for equivalency of groups therefore requires it to be placed as a subfamily of *Anatidæ*.

Fam. ANATIDÆ (chars. as above).

than in any of the following. Bill much as in foregoing, but generally not longer than head, sides converging, base very high, nail at end large, generally forming the whole tip. Lamellæ as before. Lores definitely feathered (always?). Wings mediocre, sometimes appendaged. Tail short, rounded, rather many (16+)-feathered. Tarsus reticulate; longer than middle toe (always??). Feet moderate, webs sometimes defective. Trachea simple, at least not entering sternum. Sexes usually similar. Of large and medium size; strong flyers, good swimmers, and especially good walkers; do not dive. Genera: *Anser*, *Bernicla*, *Chlaephaga*, *Cheniscus*, *Chenalopez*, *Plectropterus*, *Choristopus*, *Cereopsis*, *Sarkidiornis*, *Anseranas*, *Dendrocygna*; but some of these may be only subgenera, on synonyms.

A rather large group; none are entirely swan like, but on the other hand some forms grade toward the ducks, and their position is open to discussion. Such especially is *Dendrocygna*, but its reticulate, not scutellate, tarsi, apparently define its position. *Plectropterus* is the only armed-winged swimmer. *Chlaephaga* and *Anseranas* have more or less defective webs. The body is not so depressed in the geese as in other subfamilies; the feet are perhaps further forward; the species stand high, and walk better than any other *Anatidæ*. Some are more or less arboricole, like many ducks.

Subfam. *Anatinæ*.—Averaging smaller than either of the preceding; neck usually much shorter. Bill broad and depressed towards tip; rarely or never so high at base as in *Anserinæ*; of various details of shape, but rarely if ever gibbous. Lamellæ vertical, in single row. Wings mediocre; the scapulars or tertials never curly. Tail short, usually rounded, sometimes longer, and pointed; of varying number of, but generally few, feathers; its coverts always ample. Feet moderate, rather further forward than in the succeeding; hallux simple. Body depressed. Head sometimes crested. Sexes dissimilar. Strong flyers, good swimmers, poor walkers, scarcely diving at all; many are arboricole. Genera: *Tudorna*, *Casarca*, *Leptotarsis*, *Anas et aff.*, *Spatula*, *Aix*, *Cairina*, and others.

The river ducks have been so extensively subdivided, that many of the distinctions commonly claimed as generic are not of more than specific value. Some of these genera, so-called, could not stand a moment did they not take color from the birds' colors. I think the number must be reduced, and that *Anas* can conveniently hold some half-dozen of them.

Subfam. *Fuligulinæ*.—With the characters in general of *Anatinæ*, but the feet placed further back and wider apart, apparently, and much larger, with broader webs; the tarsi short. Hallux with a large hanging lobe. Tail sometimes narrowly long-pointed, its coverts always normal. Scapulars or tertials often curly. Bill frequently gibbous. Strong flyers, very poor walkers, excellent swimmers, and the majority dive well; decidedly marine. Genera: *Fuligula et aff.*, *Oidemia et aff.*, *Somateria*, and others.

The sea ducks form a group usually distinguishable on sight from the preceding, and well characterized; yet it is difficult to find any positive feature applicable to all, except the large-lobed hallux; this is simple in the river ducks. But the feet are comparatively much larger. The species are mostly marine, diving well, and scarcely walking. As in the preceding group, the genera are altogether too many; but, likewise as in that case, I am not prepared to speak authoritatively as to the amount of reduction that would be desirable. Above, I only indicate principal series or sets of genera. Thus *Fuligula* has grouped about it *Fulix*, *Aythya*, *Nyroca*, *Clangula*, &c., just as *Anas* has *Nettion*, *Querquedula*, *Mareca*, *Dafila*, *Chaulelasmus*, &c. *Oidemia* might contain all the "Scoters," as *Pelionetta*, *Melanetta*, &c. Another central point has grouped about it forms like *Histrionicus*, *Polysticta*, *Camptolæmus*, *Harelda*, &c. *Somateria* will embrace all the "Eiders" with gibbous, partly feathered bill. This is merely an indication of the grade of differences that I would be inclined to consider generic.

1869.]

Subfam. *Erimaturine*.—As in *Fuligulina*; but the rectrices rigid, lance-linear, acute, the coverts extremely short. Nail of bill chiefly inferior. Genera: *Erimatura* (et *Biziura* alior.); and *Thalassornis*?

A group of one, perhaps two, genera, and upwards of a dozen species, like ordinary sea-ducks, but differing in the curious condition of the tail, which corresponds to that of the Cormorants in their order.

Subfam. *Mergina*.—Bill long, slenderer and narrower, more nearly cylindric in its continuity, than in either of the foregoing. The nail narrow, forming a true hook. Upper mandible with a double series of laminae on each side, set obliquely backwards like saw-teeth, the single row in the under mandible fitting between them. Otherwise much as in *Fuligulina*. Mostly crested. Sexes dissimilar. General habitus as in the sea ducks. Genera: *Mergus*, *Merganetta*, *Lophodytes*, *Mergellus*

A small group, well characterized by the bill. It offers the most conspicuously crested members of the family. The habits of the "fishing-ducks," as they are called, are much the same as those of the sea-ducks.

**Characters of some new HEPATICÆ (mostly North American), together with Notes on a few imperfectly described Species.**

BY COE F. AUSTIN.

*SCAPANIA PECKII*, Aust.

*S. minuta*, compacte cespitosa, valde surculosa; caule subsimplici serpentino-erecto vel adscendente 3—4 lin. longo sursum accrescenti laxo vel subimbricante foliato; foliis integerrimis obtuse complicatis bilobis, lobis subconformibus late ovatis plerumque obtusis apiculatisque, dorsali parce minori; surculis sursum subdecreascentibus dissite foliatis, foliis subdifformibus acute bilobis varie modo directis complicatisque suberectis vel plerumque e basi erecto patuli-recurvis nonnullis interdum explanatis; perianthio parvo subcuneato terminali et laterali sessili valde compresso, ore truncato integerrimo saepe subrecurvo; foliis involucribus conformibus nonnullo subdenticulatis; rete foliorum e cellulis minutis subrotundis hyalinis poriformibus, intersticiis latissimis fulgido-pellucidis confluentibus instructo.—*Hep. Bor. Amer. Exsicc. ined.*, No. 20.

On old logs in woods, near Belleville, Canada West, John Macoun (1865). Adirondack Mountains, New York, Prof. C. H. Peck (1867); also about Jordansville, N. Y. (Austin 1868)

Receptacle for the minute size about the size of *Juniperus* *H. L.*

ventrali valde convexo oblique obovato-oblongo valde obtuso patenti-decurvo, dorsali dimidio minori haud angustiori minus convexo erecto-subverticali vel subappresso orbiculato vel late ovato, apice subacuto grossius dentato leniter incurvo, margine externa ad basin longe producta ciliis valde longioribus subdecompositis deflexis ornata; perianthio compresso oblongo terminali, ore subciliato.—*Hep. Bor. Amer. Exsic. ined.*, No. 19.

On Redwood trees and stumps, California, Dr. H. N. Bolander.

Remarkable for the long, deflexed, often compound ciliæ on the attenuated outer basal angle of the dorsal lobe of the leaf, and for the leaves retaining their position and shape in drying. Resembles *S. nemorosa* in general appearance, but is rather smaller than the ordinary forms of that species, with longer and narrower, more obovate, and much more coarsely-toothed leaves.

#### JUNGERMANNIA RIGIDA, Aust.

*J. examphigastriata*, subrobusta; caule decumbente flexuoso rigido nudo ex apice prolifero; foliis sursum increscentibus erecto-conniventibus arcte imbricatis oblique cordato-orbiculatis rotundatis integerrimis, margine flexuoso-undulatis præcipue dorsali subsinuatis ventrali inflexis; perianthio terminali mox laterali obovato-oblongo plurimum plicato demum versus basin nudo, ore ciliato; involucri foliis ciliatis.

Sandwich Islands. Communicated by Dr. H. N. Bolander, 1865.

Differs from *J. flexicaulis*, Nees., Syn. Hep. p. 87, in the undulate leaves—those of the involucre ciliate, and in the multi-plicate perianth.

*J. colorata*, Lehm., Syn. Hep., p. 86, differs in the leaves being more connivent and orbicular, smaller, and not undulate, &c.

*J. grandiflora*, L. & G., Syn. Hep., p. 673, differs in its small subtrifid involucre leaves, connate with the amphigastria.

#### JUNGERMANNIA ROBUSTA, Aust.

*J. examphigastriata*; caule stricto vel subarcuato erecto ex apice prolifero-continua e ventre toto longitudine radiculoso; foliis pallidis exacte verticalibus late oblique cordato-ovatis rotundatis, toto margine minutissime eroso-dentatis dorsali undulatis subsinuatis subdecurrentibus; perianthio terminali subcylindrico triangulari-subcompresso basi nudo ore plicato subciliato; involucri foliis subbilobis, lobo ventrali subciliato-denticulato, altero integro.

Sandwich Islands. Communicated by Dr. H. N. Bolander, 1865.

Differs from *J. rigida* in its pale color, much larger size, more vertical leaves eroded-dentate on the margin, in its bilobed involucre leaves, longer and less plicated perianth, and radiculose stems.

*J. colorata*, a closely related species, is smaller, with more orbicular and connivent, reddish leaves not undulate on the dorsal margin.

#### JUNGERMANNIA CORIACEA, Aust.

*J. caule repente vel adscendente subramoso radiculoso; foliis subcoriaceis rigidis arcte imbricatis madefactis patulis siccatis subverticalibus ovato-oblongis obtusis planiusculis, margine subrepandis integerrimis dorsali subdecurrentibus; perianthio magno cylindrico-oblongo sublævi, ore subplicato minute ciliato; foliis involucre libus subbilobis inciso-dentatis, basi ventrali minute lobulatis, cum stipulis parvis lanceolatis vel oblongis acute bi-quadrifidis intermixtis.*

Sandwich Islands. Communicated by Dr. H. N. Bolander, 1865.

Remarkable for its large size, and for the thick epidermis of the leaves, which are of a reddish color.

Differs from *J. grandiflora*, L. & G., Syn. Hep., p. 673, in its oblong leaves, those of the involucre slightly enlarged and not connate with the amphigastria; also in the radiculose stem. There are no amphigastria except at or near the base of the perianth, and these (about four in number) are situated on 1869.]

at least two sides of the stem, and some of them below the two outer involu-  
cral leaves, which are simply retuse at the apex and nearly entire, while the  
two inner ones are unequally bilobed and lacerate-toothed.

*JUNGERMANNIA BIFORMIS*, Aust.

*J.* caule dense caespitoso valde intricato a ventre innovante pluries ramoso,  
valde radiculoso, radiculis tenuissimis longissimis subfasciculatis supremis  
nonnullis rubris; foliis succubis vix imbricatis subcomplanatis oblique semi-  
circularibus vel late ovatis tenuibus, margine dorsali decurrentibus apice  
integris retusisve, rete e cellulis magnis subrotundis hyalinis intersticiis  
angustissimis instructo, surculorum foliis dimidio minoribus ovatis obovatisve  
valde obtusis vix decurrentibus; amphigastriis nullis; fructu ignoto.—*Hep.*  
*Bor. Amer. Exsic. ined.*, No. 20.

On wet rocks, at the Delaware Water Gap, New Jersey, 1867.

Remarkable for the closely entangled and matted stems and surculi, and  
for the leaves of two forms. The texture of the leaves is much as in *Calypso*  
*geia Trichomanis*.

*JUNGERMANNIA FOSSOMBRONIOIDES*, Aust.

*J.* caule dense caespitoso adscendente (radicibus purpureis subincrassatis)  
valde radiculoso; foliis disticho-subverticalibus arcte imbricatis orbiculatis,  
margine undulato-repandis, apice brevi uniplicatis leniter emarginatis patulo-  
subrecurvis, basi subcordatis caulem amplectentibus subventricosus radiculo-  
sis, involucribus conformibus cum perianthio alte connatis; perianthio  
maximo longiuscule exserto subcampanulato sex—decemplicato, ore hiant  
profunde laciniato, laciniis integerrimis; calyptra omnino violacea; capsula  
ovali.—*Hep. Bor. Amer. Exsic. ined.*, No. 32

On rocks along a rivulet, near Closter, New Jersey.

Remarkable for its large, subcampanulate and multi-plicate perianth. Al-  
lied to *J. crenulata*, Smith, but much larger, &c.

*JUNGERMANNIA PORPHYROLEUCA*, Nees, var.

Caule dense lateque caespitoso prostrato innovante ramoso crassiusculo  
valde radiculoso, radiculis ad cauli insertionem rubris longissimis subfascicu-  
latis, foliis plerumque rubris pallido viride plus minus variegatis subverticalibus  
obtusissimis subcomplicatis e basi erecta subrecurvis oblongo-quadratis sub-  
cuneatisve emarginato-bilobis integerrimis, sinu obtuso, lobis plerumque  
acutis subinaequalibus incurvis; perianthio adscendente subclavato valde  
exserto a tergo ventreque subappresso apice obtuse 3—4-plicato ore con-  
nate subclavato foliis succubis plus minus majoribus apice subtruncato

caulem oblique insertis undulatis flexuoso-patulis late amplexicaulibus (vix complicatis) late cuneato-quadratis integerrimis truncato bi—trilobis, margine obtuse 1—3 undulato-plicatis (basi media vix saccatis); fructu terminali (in auctumno matur.), perianthio valde elongato (circa 3 lin. longo) subcylindrico nudo apice subplicato ore minute ciliato; foliis involucralibus binis latissimis brevissimis valde cristato-undulatis obtusissime plurimum lobulatis. —*Hep. Bor. Amer. Exsic*, No. 46.

In a peat bog near Closter, New Jersey; growing among *Sphagna*, and associated with *J. Taylora*, *J. inflata*, *J. connivens*, etc.

The sterile plant agrees perfectly with authentic European specimens. The fruit appears to have been collected now for the first time, and is extremely rare in our locality. The leaves on the horizontal and fertile stems are crisped and wavy, much as in most *Fossombronix*. The former often bear little balls of green gemmæ on the apices of their lobes, and are subhorizontal and frequently imbricated, while the latter, *towards the perianth*, are usually 1—3 lines apart, subopposite and erect. The leaves, particularly on the erect stems, are about as often two as three lobed, and can hardly be said to be complicate, or either saccate at the base. The stem is usually very conspicuous on account of its blackish color. The perianth is whitish or membranaceous above, and at first subtriquetrous.

#### JUNGERMANNIA WALLROTHIANA, Nees.

"Nigricans, minutissima. Caule repente, adscendente, subsimplici vel innovante ramoso, vix  $\frac{1}{2}$ —1 linea longo, valde radiculoso; radicibus crassis papilliformibusque. Foliis diametro caulis latioribus, amplexantibus, firmis, ovato-quadratis, arcte imbricatis, semiverticalibus, concavis, sursum conniventibus, emarginato-bidentatis; sinu vel obtuso in foliis inferioribus, vel acuto in foliis superioribus; dentibus obtusiusculis integerrimis; margine pellucidis; areolatione distincte, cellulis ovato polygonis, olivaceis, margine tantum pellucidis. Foliis involucralibus majoribus, erectis, tridentatis, undato-plicatis, basi connatis; dentibus acutis vel obtusis. Perianthio ovali-cylindrico, superne contracto, plicato; ore subdentato, pellucido, inferne rubello." (Lesqx. in Herb.)

On coarse sand, on the slopes of the White Mountains of New Hampshire, Oakes.

A very minute species, but more than twice the size of *J. Sullivantii*, from which it is also distinguished by its entire leaves, papillæform rootlets, and different perianth. Leaves round-ovate, thickish,  $\frac{1}{3}$ -bifid, the lobes triangular-ovate, acute; cellules irregularly angled, subquadrate or oval, rather uniform, largish for the size of the leaf (about ten across its widest part), opaque, with broad hyaline spaces between. Apex of the lobes hyaline, often slightly eroded on the margin. Color dark or olive-brown. Perianth terminal, subpyramidal, cleft about one-third way into about six sublinear truncate lobes, the apex white and pellucid, the middle and base dark brownish-red: the mouth crenulate by the protrusion of the ends of the very large, oblong cells, of which the upper portion of the perianth is composed. Leaves of the involucre enlarged, entire on the margin.

#### JUNGERMANNIA SULLIVANTII, Aust.

*J. amphigastriata*, minutissima, olivaceo-vel saturate viridis; caule circa  $\frac{1}{2}$ — $\frac{1}{3}$  lin. longo carnosio valde radiculoso, fructifero suberecto clavato, sterili repente subfiliformi vel subjulaceo; foliis imbricatis caule sæpe angustioribus ovato-orbiculatis vel subquadratis erecto-subverticalibus plus minus dentato-serratis bifidis, sinu acutiusculo, dentibus acutis; amphigastris (solum versus apicem in caule sterili observatis) lanceolato-ovatis strictis integris (folii lobo fere similibus) suberectis; perianthio circa  $\frac{1}{2}$  linea longo late ovali subobovato obtuse parceque angulato, apice paulum plicato truncato, 1869.]

ore connivente lobulato-dentato nonnullo anguste scarioso; involucri foliis tribus erectis haud coalitis; pedicello longitudine semilineari; capsula ovali.—*Hep. Bor. Amer. Exsic. ined.*, No. 50.

*J. divaricata*, Sulliv, Musc. Alleghan. N. 239.

On very rotten wood near Columbus, Ohio, Sullivant. About Closter, New Jersey, and Jordansville, New York. Also near Belleville, Canada West, Macoun.

Remarkable for its extremely minute size. Differs from *J. divaricata*, Engi. Bot., in the much smaller size of the whole plant, particularly the perianth, in the larger, sublanceolate amphigastria, in the discrete involucreal leaves, and in the roundish, less quadrate and less angular cells of the leaves.

*JUNGERMANNIA MACOUNII*, Aust.

*J. caule compacto lateque caespitoso tenui valde innovante ramuloso, ramulo fructifero brevissimo ventrali; foliis caule latioribus subimbricatis erecto-subverticalibus subcomplicato-concavis e basi angustiori subcuneato-quadratis ultra medium bifidis, sinu plerumque lato obtuso, laciniis triangulari-lanceolatis vel subulatis rectiusculis sub pressura divaricatis, areolis parvisculis angularibus; perianthio minuto albido subtrigono ovali-obovato gibbositate subinflato, apice contracto subplicato, ore denticulato ciliatove; involucri foliis subovatis subinaequaliter bi-trifidis serratis longe ciliatisve.*—*Hep. Bor. Amer. Exsic. ined.*, No. 55.

On decayed logs in woods, Canada West, John Macoun.

Differs from *J. divaricata* in the more matted stems, in the rather wider, more complicate leaves with an obtuse sinus; and chiefly in the much shorter, white, and differently shaped perianth, which is situated on a short ventral branch. The habitat (old logs) is also different. Color very dark green, changing to dark fuscous- or brownish-green in the herbarium. Perianth shaped much as in *J. Helleriana*, Nees.

*JUNGERMANNIA PLENICEPS*, Aust.

*J. caule dense caespitoso perbrevis e ventre valde radiculoso innovanteque ramoso; foliis incrassatis orbiculatis valde concavis verticali-conniventibus subsemiamplexicaulibus ad  $\frac{1}{2}$  bifidis, sinu acutiusculo obtusove, lobis omnino acutis incurvis valde conniventibus; fructu in ramulo ventrali terminali, perianthis confertissimis magnis oblongo-cylindricis obtuse trigonis, ore plicato denticulato hinc laciniato; involucri foliis rectis oblongis bi palmato-quadrifidis nonnullis stipuloides; rete foliorum e cellulis amplissimis subrotundis hyalinis instructo.*

curvis, superioribus majoribus extrorsum utrinque unidentatis vel palmato tri-quadripartitis, apicalibus sublanceolatis anguste bifidis extrorsum repando-dentatis; fructu —.

On the ground, Illinois, E. Hall.

Remarkable for the obtusish lobes and crenulate margin of the leaves. A very small species.

LOPHOCOLEA MACOUNII, Aust.

*L. minutula*, condensata, læte viridis; caule perbrevis prostrato dense fasciculato radiculoso innovante ramoso ad apicem adscendentem incurviusculo: foliis erectiusculis ovato-subquadratis retusis vel emarginato-bilobis aut sæpe integris, margine leniter repanda crenulatis, sinu lobisque obtusis vel acutiusculis his rectis vel curviusculis, rete e cellulis magnis intersticiis angustissimis hyalinis instructo; amphigastriis profunde bifidis (trifidisve?) sinu lato obtuso, laciniis serie cellularum 1—2 instructis filiformibus patulo-incurvis, colore læte caryophylloideis; perianthio subobovato leniter trigono, apice cristato-dentato sæpe in uno latere profunde obtuseque inciso, angulis laud vel vix alatis; involucri foliis majoribus suboblongis subrepandis apice valde inæqualiter 2—4 repando-dentatis; amphigastriis valde majoribus lanceolatis minus profunde bifidis repando-dentatis.—*Hep. Bor. Amer. Exsic. ined.*, No. 66.

On old logs in woods, hidden among other *Jungermannia*, Canada, Macoun; also near Little Falls, New York.

About the size and with much the general appearance (when sterile) of small forms of *Jungermannia scutata*, resembling it in the color, general form, position, and in the areolation of the leaves. Remarkable, among other things, for the light pink color of the amphigastria, with thread- or necklace-like divisions (usually composed of a single row of cells.) Differs from the preceding species in its much smaller size, densely radiculose stems, shorter and less deeply lobed leaves, &c.; and from *L. minor*, Nees., in the more obtusely lobed, often entire leaves. The lower leaves are usually rather deeply and acutely lobed, while the upper ones are only emarginate or retuse, or often quite entire at the apex.

? GYMNANTHE BOLANDERI, Aust.

*G. caule* eradiculoso prostrato subimbricato e ventre innovante ramoso complanate foliato  $\frac{1}{2}$ — $\frac{3}{4}$  unciali; foliis succubis stricte patentibus lineari-oblongis subfalcatis integerrimis planis, apice rotundatis vel oblique subtruncatis aut nonnullo inæqualiter emarginato-bilobis, margine dorsali subdecurventibus; rete e cellulis laxis maximis heteromorphis discretis, intersticiis latis hyalinis instructo; amphigastriis (inferne obsoletis) minutis oblongo-ovatis longe bicornibus, sinu obtuso, laciniis subulatis paralellis; fructu —.

Sandwich Islands. Communicated by Dr. H. N. Bolander, (1865.)

A neat and pretty little plant, about the size of *Lejeunia serpyllifolia*: the form of the leaves suggesting a *Plagiochila*, but the general appearance of the plant is still more suggestive of a *Saccogyna*, and, indeed, I am not sure but that it ought rather to have been referred to this latter genus than to GYMNANTHE. The cells of the leaves are very large and loosely arranged, and are usually furnished with broad and short projecting points. They also vary greatly in size and position, being roundish or oblong, and frequently some of them are obliquely or even transversely disposed through the leaf. Those on the margin are usually narrower than the others, and vary from subquadrate to elongated-oblong or parallelogrammoid. The cells of the stem are also very loosely disposed; however, they are still larger than the leaf-cells, and uniformly oblong.

CALYPOGEIA BIFURCA, Aust.

*C. albida*, cæspitosa, parvula; caule prostrato e ventre apiceque valde flagellifero-ramoso circa 3—5 lin. longo, dorso in statu siccati convexo (nec canaliculato) ob cellulis oblongis eleganter striolato perspicue secus foliorum

basin cum cellulis maximis oblongis hyalinis marginato; foliis imbricatis late et suboblique ovatis margine-inferiori abrupte decurrentibus supra valde convexis siccate non mutantibus apice pro genere lato subcontractis emarginato-bidentatis, dentibus triangulari-subulatis rectis vel plerumque divaricatis, sinu plerumque lunulato; rete e cellulis hexagonis magnis hyalinis, versus basin oblongis, versus apicem rotundatis ac sensim minoribus, secus marginem angustioribus plus minus quadrangularibus transversimque elongatis instructo, amphigastriis valde dissitis minutis caule angustioribus vel cum vix excedentibus ovatis vel reniformi-rotundis obtuse profundeque bilobis, laciniis rectis subulatis integrisque vel subrotundis divaricatis ac iterum bifidis.

Sandwich Islands. Communicated by Dr. H. N. Bolander, (1865.)

A neat and pretty little species. Possibly too near the Mexican *C. lewisii* L. & G., *Syn. Hep. p.* 713, but nothing is there said about the flagiliferous ramification, a striking feature of our plant; and the leaves are said to be large and minutely bidentate, characters which do not agree with our plant, whose leaves do not change their shape in drying, and, for the genus, are pretty strongly toothed. The peculiar bifurcation of most of the amphigastria, and the transverse elongation of the marginal cells of the leaf, appear to be generic characters (specific only in degree), as they occur (in a less degree) in *C. Thromasii*, and at least in two other species.

#### PHYBLOTUM SUBINFLATUM, Aust.

Ph. foliorum lobulis subinæqualibus lanceolatis acuminatis circa  $\frac{1}{4}$ — $\frac{1}{2}$  liberis, dorsali convexo, margine exteriori versus basin inflexo subbidenticulatoque, apice subconvoluto dentibus parvis rectis acutis minute bifido; ventrali parce minori convoluto-concavo, basi ob margines coalescentes breviter tubuloso non appendiculato, margine interiori subulato, ad apicem angustum sublingulato obtusiusculo integro et integerrimo vel eroso-denticulato.

Sandwich Islands. Communicated by Dr. H. N. Bolander, (1865.)

Remarkable for the subequal acuminate lobes of the leaf; the lower one not appendiculate, and inflated only at the base, convolute-concave above.

#### POLYOTUS PECHIANUS, Aust.

P. caule repente pinnatim vel bi—tripinnatim ramoso, ramulis dissitisculis patuli-recurvis  $\frac{1}{4}$ — $\frac{1}{2}$ -uncialibus subattenuatis; foliis arctissime imbricatis subovatis obliquis convoluto-decurvis inæqualiter bi—trilobis integerrimis basi utrinque auriculatis, sinu angusto, lobis ovatis acutis vel subapiculatis aut rare obtusis inferioribus incurvis; auriculis subparvis oblongo-lanceolatis canaliculato-concavis, ventralibus stricte patentibus caulem arcte amplexentibus.

Sandwich Islands. Communicated by Dr. H. N. Bolander, (1865).

Differs from *S. fissa*, Nees, in the leaves being much less deeply fissured at the apex.

*PHRAGMICOMA ELONGATA*, Aust.

Ph. caule stricto parce innovante diviso subbiunciali; foliis late subfalcato-ovatis convexis patuli-recurvis et decurvis fere linea longis apice serratis subacutis vel obtusis, lobulo minuto subinflato mutico in folii margine trans-cusate; amphigastriis squarrosis cauli duplo latioribus orbiculatis subreni-formibusve subtus concavis, margine omnino minutissime serratis; perianthio parvo a lateribus compresso fere sessili subdecem-alato cæteroquin lævi.

Sandwich Islands. Communicated by Dr. H. N. Bolander, (1865).

A large species, being about the size of *P. semirepranda*, Herb. Lehm., but the leaves are less strongly toothed, and the perianth more numerously angled, the angles winged, &c.

*PHRAGMICOMA SUBSQUARROSA*, Aust.

Ph. caule brevi flexuoso compacte cæspitoso rigido apice suberecto; foliis minutissime imbricatis in siccis subsquarrosis undulatisque obovato-rotundis maxime areolatis, lobulo majusculo semiro-tundo-ovato vix inflato; amphigas-triis caule duplo vel triplo latioribus reniformibus apice subrecurvis; perian-thio obovato haud compresso circa 10-alato cæteroquin lævi.

Sandwich Islands. Communicated by Dr. H. N. Bolander, (1865).

Perianth terminal, at length lateral, deeply and closely grooved or angled, crowned with a very minute cylindrical tube. Calyptra crowned with a very long style. Elaters very large, containing a single thick, imperfect fibre. Leaves margined by a row of diminished, subequal cellules.

? *LEJEUNIA BISERIATA*, Aust.

? L. foliis rufo vel fusco-brunneis siccatis convoluto-adpressis madefactis puerilibus oblongo ovatis integris convexis, supra minute eleganterque papil-latis. toto margine inferiori late inflexis; amphigastriis biseriatis alternatis florum medio oppositis basi ad caulem exacte diagonè insertis erecto-duricatis lineari-oblongis obtusis in longitudine circa  $\frac{3}{4}$  folii metientibus; fructu —.

Near Augusta, Georgia, Sulliv., (1845).

About the size and color of *Frullania Virginica*. Remarkable for the genuine papillæ on the surface of the leaves and amphigastria, for the broadly inflexed ventral margin of the leaf, and chiefly for the double row of amphigastria. These are alternate with, and equal the leaves in number. They are  $\frac{3}{4}$  as long as the leaves and less than  $\frac{1}{2}$  as wide, and are placed diagonally or obliquely opposite them, and about midway between their upper and lower margin. Areolation and texture of the leaves much as in *Frullania Virginica*. The rootlets are remarkably stout, and of a brown color, and few in number; and proceed from the whole under surface of the stem as well as from the base of the amphigastria. A few stems only of the plant, without fruit, were found in Mr. Sullivan's collection, mixed with *L. serpyllifolia* and *L. Sullivantæ*. Diligent but unsuccessful search was made for more of it, among numerous specimens from the same locality.

*FRULLANIA SAXICOLA*, Aust. MSS., (1865.)

*F. digyna*: caule brevissimo arcte repente vage innovanteque pluries ramoso; foliis orbiculatis (vix obliquis) planis vel subconvexis aut nonnullo leniter concavis subassurgentibus, auriculis cauli approximatis rarissime majusculis subrotundis galeiformibusque autem fere semper parvis explanatisque; am-phigastriis minutis caule non vel parce latioribus subobovatis bifidis integer-nis. sinu lobisque plerumque obtusis; perianthio compressiusculo oblongo majusculo, ore brevissimo pateriformi papuloso, dorso convexo, ventre abrupte  
[1869.]

lateque carinato, utrinque uni—plurinervoso, carina biangulata, nervis sagittisque plus minus alatis undulatisque.—*Hep. Bor. Amer. Exsicc. ined.*, No. 104.

Closely adhering to the surface of steep shaded rocks, near Closter, New Jersey; very rare. Also, Texas, Wright in Herb. Sulliv.

Remarkable for the short, innovately much branched stems, and orbicular plane, subascending, scarcely if at all oblique leaves, with the auricle almost always expanded into a small, oblong, concave, obtuse lamina. Areolation of the leaves distinct, scarcely enlarged in the centre at the base. Perianth longer than in *F. Virginica* and more exerted, but angled much in the same manner; however, the angles are never created, and the "style" or mouth is very different; (tubular and considerably elongated in *F. Virginica*). The stems are much shorter, the leaves larger, and the perianth very different from *F. Eboracensis*.

*FRULLANIA SULLIVANTII*, Aust.

*F. digyna*; caule arcte adpresso vage breviter ramoso; foliis subrotundis convexis integerrimis obtusis, auricula magna galeata rotunda latitudinem folii  $\frac{1}{2}$  æquante cauli adproximata; amphigastriis obovatis obtuse bifidis subserratis caule parce latioribus illis versus perianthium oblongis cuneatis, lobis obtusissimis vel supremis acutis; perianthio obovato subcompresso breviter rostrato, dorso minute 1 (—2)-nervoso, ventre unicarinato, carina biangulata hialatave; involucri foliis rotundis cum perianthio et uno alterove cum amphigastriis connatis, lobulis parallelis subæqualibus, (ventrali  $\frac{1}{2}$ — $\frac{1}{3}$  angustiori).

On the bark of trees, Georgia, Sullivant; also South Carolina, Curtis (in Herb. Sulliv).

Differs from *F. inflata*, Nees, in the fewer and less distinct nerves on the back of the much more compressed perianth, in the shorter amphigastria, in the auricle placed close to the stem, &c.; and from *F. Oakesiana* in the different perianth, smaller auricle, more unequal lobes of the involucrial leaves, &c.

*FRULLANIA OAKESIANA*, Aust.

*F. monogyna*; caule vage ramoso intricato, ramulis fertilibus brevibus suberectis; foliis suboblique orbiculatis laxè imbricatis subconvexis margine leviter repandis, auriculis maximis (folia fere sequantibus) rotundatis cucullato-galeatis cauli fere contignis, lobulo dentiformi interjecto nullo vel fere obsoleto; amphigastriis ovato-rotundis vel subobovatis caule parce latioribus bifidis integerrimis subserratisve; perianthio parvo subobovato subinflato ventre late carinato, utrinque varie numero (1—7) nervoso vel alato, caeteroquin lævi; involucri foliis bilobis integerrimis cum amphigastriis uno alterove subalte connatis, lobis æqualibus obtusis parallelis.

On the bark of *Betula piceola*, in the region of the White Mountains of New

On the bark of *Negundo aceroides*, "Tomales Bay," California, Bolander, (1864).

The flagellæ are nearly erect, about as high as the fertile branches, and clothed on the underside with crowded, squarrose amphigastria, but are without leaves except at the apex, where these are crowded into little tufts or heads, and are not mixed with amphigastria.

A small species; scarcely as large as *F. Eboracensis* (which has somewhat similar flagellæ), and differing from it chiefly in the 2—4 nerves on the back of the perianth, in the involucral leaves connate with the amphigastria, and in the compressed (much as in *F. squarrosa*) auricle of the leaf.

#### FRULLANIA LEANA, Aust.

*F. pusilla*, rufo-brunnea; caule brevi—; foliis rotundato-ovatis obtusis omnino crassiusculo apiculatis, auriculis fere maximis subcylindricis obliquis a caule valde distantibus oblongo-areolatis basi dependente distincte crenulato-dentatis; amphigastriis majusculis oblongis bifidis integerrimis planis rectis caulis latitudinem parce excedentibus; perianthio e basi subattenuata obovato-oblongo multum exserto lævi dorso plano ventre unicarinato apice subtruncato, rete ad basin maximo oblongo supra medium minuto heteromorpha maxime stelliformi; involucri foliis cum amphigastriis (semper?) connatis margine sinuato-dentatis, lobulis plus minus incisus erectis paralellis, amphigastriis valde majoribus parce inciso-dentatis.

On trees near Cincinnati, Ohio, T. G. Lea (in Herb. Tayl. mixed with *Lejeunia longiflora*).

Remarkable for the very large, oblong, distant auricle, obtusely dentate at the base, and for the thickish, apiculate leaves.

A very small species, about the size of *F. Drummondii*, Tayl.; from which, however, it is readily distinguished by its more imbricated, apiculate leaves, by the much larger auricle very distant from the stem, and with a very distinct tooth-like lobe on the margin of the leaf close to its base. The perianth is also differently areolated, and the perichaetal leaves are toothed on the lower lobe, or even incised.

#### FRULLANIA MAURITIANA, Aust.

*F. tetragyna* (semper?); caule bi—tripinnato flexuoso; foliis siccatis caulem subcircumvolutis madefactis patentibus e basi valde angustata oblique (subfalcato-) ovatis, apice deflexo-incurvis longiuscule acuminatis apiculatisve, rete e cellulis (marginalibus subrotundis exceptis) angustis linearibus oblongisve plus minus sinuosis in centro subhyalinis, intersticiis latissimis (quam cellulis parce latoribus) obscuris confluentibus instructo; auricula oblongo-cylindrica mediocri oblique a caule distant; amphigastriis e basi angusta late obovatis planiusculis vel margine versus basin subrecurvis ad  $\frac{1}{3}$ — $\frac{1}{2}$  bifidis, sinu angusto obtuso, lobis acutis; perianthio oblongo, dorso lævi, ventre unicarinato, apice longe rostrato; foliis amphigastriisque involucrialibus erectis adpressis, lobis ovato-lanceolatis inciso-serratis.

Island of Mauritius. Communicated by Prof. Chas. H. Peck.

Readily recognized by the very narrow base, acuminate apex, and narrow subsinuous cells of the subfalcate leaf; by the largish, subcylindrical, oblique auricle distant from the stem; by the nearly plane and strongly incised lobes of the involucrial leaves and amphigastria. The lower margin of the leaf, between the auricle and the stem, is narrowly but distinctly inflexed; it is also furnished with a minute, cilia-like tooth, which is close to the auricle, and composed of about six roundish cellules arranged in a single row.

#### FRULLANIA ORBICULARIS, Aust.

*F. monogyna*; caule lato extenso bi—tripinnatim decomposito circa 3 unciali, ramulis plus minus divaricato-recurvis; foliis laxè imbricatis majusculis oblique ovatis vel ovali-auriculæformibus convexis subpellucidis, apice 1869.]

obtusio plus minus decurvis, rete e cellulis minutis subrotundis marginibus sinuatis, illis ad basin valde majoribus obscuris, intersticiis latis subobscure instructo; auricula tecta cucullata valde compressa parva subovali canli adproximata; amphigastriis magnis orbiculatis planis apice integris vel rare submarginatis margine leniter repandis; perianthio oblongo subexserto, dorso plano convexo, ventre (carina valde compressa) unicarinato; involucri foliis semicordato-ovatis acutis integerrimis vel subundulato-repandis, lobulis longiori lineari-setaceo canaliculato, amphigastriis elongato-lanceolatis profunde bifidis subintegerrimis

Nepal. Herb. Sulliv.

Readily distinguished from *F. integristipula*, Nees, by the fertile flower containing but a single pistil, by the orbicular amphigastria plane on the margins, by the cucullate, suboval, compressed auricle, &c.

#### FOSSOMBRONIA CRISTELA, Aust.

*F. minuta*, albens; caule perbrevis (1—2 lineas longo) arcte repandifurcatim vel fastigiatim diviso, radicibus plerumque purpureis terram affixis; foliis angulariter lobulatis subintegrisve quadratis vel obovato-rotundis subdifformibus plerumque basi subangustatis atque apice valde undulato-crispatis; perianthio fere ut in *F. pusilla*; involucri nullo? capsula in pedicello brevissime immersa, sporis pallido-fascis parce subgrosseque tuberculatis circa 1-600—1-700 unc. metientibus; elateribus delicatissimis hyalinis unicellularibus brevibus crassiusculis plus minus difformibus, fibre tenuissimo pallido-fusco annulari et spirali (plerumque partim annulari ac partim spirali) depictis.—*Hb. Bor. Amer. Exsic. ined.*, No. 121.

On damp sand, associated with *Dicranum cerviculatum* and *Jungermannia crenulata*, in an unfrequented path, near Batsto, New Jersey, (Oct., 1868).

Remarkable for its small size, and very delicate, often somewhat branched elaters of more or less variable shapes (much as in the *Anthocerotum*), and with the single fibre usually partly annular and partly spiral in the same example. Antheridia few and large, oval or roundish obovate, nearly sessile on the back of the stem. Pistillidia (about 20) somewhat crowded towards the apex of the stem, above the antheridia, and just below the perianth, and partially immersed in the stem; not involucriate, or very imperfectly so.

#### ANDROCRYPHEIA LONGISETA.

*Fossombronia longiseta*, Austin, MSS, 1864.

*A. dioica*: caule suberecto vel depresso 3—4 lin longo e dorso proliferosissimo, radicibus terrestribus terram affixis, foliis rotundis subobovatis sub-

broader than long, and subhorizontal; on the ascending ones they are more or less attenuated and 1—2 costate at the base, and erect or nearly so. In length the style is  $1\frac{1}{2}$  times, and the elaters 3—5 times, the diameter of a spore. Spores with more numerous and larger muriculæ than in *Fossombronia pusilla*.

Separated from *Fossombronia* chiefly by its dioicous inflorescence, and by the perianth being (apparently at least) an expansion of the apex of the stem.

**PLAGIOCHASMA ERYTHROSPERMA**, Sulliv. in Herb.

*P. fronde expanso-obovata* (3—5 lin. lat.) pallido-viridi rugulosa late fuscescente marginata, subtus dense radiculosa squamosaque; squamis albidis setaceo-incisis versus apicem ultra marginem exstantibus; pedunculo 5—8 lineas alto basi nudo apice paleaceo; sporis aurantiaceo-rubris tuberculatis; elateribus 4-spiris.

Rocky Mountains, E. Hall.

Remarkable for the red spores, and for the white, fringe-like scales extending beyond the margin of the frond towards the apex.

**SAUTERIA LIMBATA**.

? *Grimaldia limbata*, Austin, MSS., 1865.

*S. fronde obovato-oblonga subdichotoma concava reticulato-papulosa læte viridi latissime marginata, subtus nigro-purpurea valde incrassata, margine nigro-purpurea membranacea subplicata undulato-crenata involuto-incurva; squamis arcte imbricatis sanguineo-purpureis, inferioribus amplis obliquis bicornibus nodoso-dentatis juxta marginem positis, superioribus majoribus lanceolatis attenuatis frondis marginem superantibus incurvis; pedunculo subunciali pallido nudo; receptaculo femineo 1—3-carpo, subtus multum sed breviter paleaceo.*

Under wet rocks. California, Bolander. (No. 4619.)

Remarkable for the broad, wavy, dark purple, membranaceous margin of the frond. The scales towards the apex of the frond increase in size and become abruptly two-horned; these horns (laciniæ) are very long and narrow, and extend beyond the margin of the frond as a strongly inflexed fringe; the very apical ones are triangular-subulate or setaceous, bifid or entire, and extend still farther beyond the margin of the frond, and in the fertile plant they become (by age) whitish. Pedicel sulcate, naked at the base. Receptacle very obtuse (1-fruited in our meagre specimen).

? **SAUTERIA CRASSIPES**, Aust.

? *S. fronde obcordata subcuneatave bifida fuscescente-purpurea vel viridi supra subpapuloso-reticulata minutissime porosa, squamis ventralibus purpureis apicem superantibus; pedunculo breviusculo (6—8 lin. alto) parcissime paleaceo, circa basin nudo vel parce barbato-involucrato, versus apicem incrassato; receptaculo femineo 4—7 inciso-lobato, subtusque eodem numero carpo brevissime submultumque paleaceo; capsula firmisscula distincte pedicellata; elateribus tri(—quadri?) spiris; magis immatura.*

Japan, on hillsides. Com. Rodgers, N. Pac. Expl. Exped.

I have doubtfully referred this species to *Sauteria*. It resembles *Preissia* very much,—also, in some respects, *Duvalia*. It is remarkable for the pedicel being much thickened towards the apex. There are occasionally a few scale-like palea on the peduncle, and a few filamentose scales or hairs on the frond about its base. Involucre rather large, somewhat flattish, fuscous-green tinged with purple, and it bears as many capsules, underneath around the margin, as there are lobes. On account of the immature state of the specimens, it is not possible to tell in what manner the capsule ruptures.

? **DUVALIA INTERMEDIA**, Aust.

? *D. fronde parviuscula obcordata subcuneatave subbifida concava (2—4 lin. longa 1—2 lin. lata) laxa texta crassiuscula anguste albido submarginata* 1869.]

vesciculoso-striolata in estate valde foveolata, subtus plus minus purpurea et squamigerula, squamis purpureis margine non attingentibus; pedunculo frondi continuo longiusculo nigro-purpureo, basi apiceque multum ac toto longitudine parvisime albo-paleaceo, involucre hemisphærico, apice papuloso-cavernoso; capsula sessili vel brevissime pedicellata supra medium deoperculata; sporis flavis tuberculatis subpellucido cinctis; elateribus bispiris.

On dry hills. Com. Rodgers, N. Pac. Expl. Exped.

The general appearance of the peduncle and of the involucre is that of a *Grimaldia*, but the loose texture of the involucre and of the frond are as in *Davalia*, and it is difficult to decide to which of these, probably too closely allied genera, our plant belongs.

*FIMBRIARIA BOLANDERI*, Austin, MSS. 1865.

*F.* fronde anguste linearis ( $1\frac{1}{2}$ —2 lin. lata, 6—10 lin. longa) solida indistincte porosa cineraceo-viridi depresso-canaliculata, subtus carinato incrassata nigro-purpurea squamosa, margine membranacea albido-pellucida vel purpurea undulato-crenata siccate arcte convoluta; squamis saturate purpureis marginem non attingentibus; fructu ex innovationis apice laterali, pedunculo tenuissimo pollicari vel sesquipollicari pallido-purpureo versus basin parvisime piloso, receptaculo femineo parvo tetracarpo subconico siccate subdepresso apice umbonato subverrucoso, perianthiis subradiatis subglobosis subdecemfidis albidis apice coherentibus.

Innovationes e ventre versus basin frondis egrediores, brevissimæ ( $1\frac{1}{2}$ —2 lin. longæ), subclavatæ, subtus dense squamosæ radiculosæque, apice dilatato emarginato-bilobæ: plerumque masculares (vel steriles?). Elateres tri-quadri-piri. Spore fuscæ, papilloso-reticulatæ, margine pellucida cinctæ.

San Rafael, California. Dr. H. N. Bolander, 1865.

A small species, about the size of *F. pilosa*, Tayl. Remarkable for the numerous ventral innovations, which bear the fruit and male flowers. *F. echinella*, Gottsche de Mex. Leverm., p. 271 (*F. violacea*, Austin, MSS. 1866,) which Dr. Bolander has also found in California, appears to be the only other known species having this peculiar character.

*FIMBRIARIA VESCICULOSA*, Aust.

*F.* fronde carnea vesciculosa incrassata subpalmatim vel furcatim lobata, supra subelevato-papulosa eporosa, laciniis subobovatis madefactis margine erecto-appressis vel subinvolutis; squamis fusco-purpureis versus apicem margines excedentibus; pedunculis singulis vel binis circa  $\frac{1}{4}$ -uncialibus

Remarkable for the somewhat lamellated surface of the frond and involucre; the latter with a very broad, abrupt, subcontracted, scarious margin, which usually forms nearly half its length.

CRYPTOCARPUS, (gen. nov.) Aust. MSS., 1864.

Frons laxa spongioso-reticulata, irregulariter subpalmatim lobata, tenuis, epidermide haud distincta. Costa nulla. Radices intus non papilloși (ut in *Sphaerocarpo*), longissimi, intertexti. Fructus in frondis substantia immersus (ut in *Riccia*). Sporangia depresso-globosa, singulatim nata, non libera. Calyptra stylo nigro persistente coronata. Sporæ 4-jugæ (ut in *Sphaerocarpo*), vix solutæ, in aspectu singulæ et profunde quadrilobæ.

A genus intermediate between *Riccia* and *Sphaerocarpus*, having the characters of vegetation and spores of the latter, while the fruit is immersed in the frond as in the former genus. Represented by a single species, which occurs both in the Southern States and in France.

CRYPTOCARPUS CURTISII, Aust. MSS., 1864.

*Riccia Curtissi*, James, in Herb. (fide Curtis).

Fronde caespitosa valde imbricata fibroso-papulata, laciniis inciso-lobulatis margine crenatis; sporangiis maximis in statu siccati latentibus sed frondes lutescentæ sunt in substantia earum ut maculis nigris apparentibus; sporis fæco-nigris valde muricatis.

On moist ground, South Carolina, Ravenel (in Herb. Sulliv., 1849). North Carolina, Curtis (l. c., 1853). "Montand après Marseille" (Herb. Lanning, ex Herb. Torrey").

To the naked eye the dried specimens look like little heaps of some filamentose conferva. In this state the frond is very brittle, and, on account of its loose texture, appears to be deeply pitted and fibrose and papulose above. Upon moistening the specimens the fronds become tough (much as in the *Anthocerotæ*), the upper surface loses its pitted appearance, and the interstices (apparent fibres) between the large cells close up; and the fruit, which was completely hidden before, now appears as a black spot in the substance of the frond. Upon re-drying the specimens the fronds become much thinner than they were at first, and the fruit remains visible, protruding from the upper surface. The frond is larger than in *Sphaerocarpus Michellii*, from the Southern States, but lobed and reticulated in the same manner. The extreme apices of the lobes are often suddenly contracted and subsolid (much as is often seen in the *Anthocerotæ*.) The base of the divisions are contracted and subsolid, and the rootlets are smooth on the interior surface as in *Sphaerocarpus*. The divisions are flabelliform, and palmately or incised-lobed, and lie so closely over one another as to be separated with difficulty, the upper ones, by their numerous long rootlets, knitting firmly to the pitted surface of those immediately beneath them. The lobes are crenate and obtuse, not emarginate, extremely thin and hyaline. Spores firmly united in fours into a sort of nucleus which is deeply 4-lobed, and very beautiful under the lens,—more deeply lobed than in *Sphaerocarpus terrestris* and more finely reticulated and papillose. [From narrowed places in the divisions (as it were sinuses) there appears to arise young plants, folded over on the back of the parent frond in such a manner that they seem to arise out of its back near the margin. Whether this is really the case, or only apparent, can only be determined by fresh specimens.]

RICCIA ALBIDA, Sulliv., in Herb., 1853.

R. fronde solida albida alternatim bifurcatimve divisa; lobis ( $\frac{1}{2}$ — $\frac{3}{4}$  lin. lat.) oblongis creberrimis anguste profundeque sulcatis, apice rotundatis subemarginatis, subtus subsquamosis valde radiculosis; epidermide superiore (tuni in canalibus fundo) spongioso-papulosa profunde foveolata quam frondis substantia crassiori; fructu ignoto.

Texas, Dr. Charles Wright.

1869.]

This species is remarkable for its thick, spongy epidermis of a whitish color, much as in *R. bullosa*, Link.; but that is a much larger species, with the lobes of the frond not so much crowded, and with the upper surface rugulose.

*RICCIA ARVENSIS*, Aust. MSS., 1863.

*R. fronde solida subciliata incrassata orbiculari subradiatim pluries divisa subgregario-imbricata in diametro 4—8 lineari, supra papuloso-reticulata obscure viridi vel demum secus margines purpurea, subtus nuda vel obsolete squamosa valde obtuseque carinato-incrassata ob sporangia tumentia valde nodosa; lobis obtusiusculis obsolete emarginatis lineari-ellipticis vel fere linearibus dichotomis versus apicem incrassatam leniter dilatatis, apice in statu juniori subadscendentibus vix canaliculatis, in ætate horizontalibus subcompressis-acuminatis evidentius lateque sulcatis, margine planis acutis (in adpectu incrassatis obtusisque); ciliis albidis brevissimis omnino inconspicuis subobsoletisve; fructibus primum versus apicem loborum infra canalem aggregatis, sporis angularibus fusco-atris reticulato-muricatis—Hep. Bor. Amer. Exsicc. ined., No. 141.*

Var  $\beta$ , *hirta*. Statura majora, fronde subtus magis purpurea et squamigerula margine evidentius ciliata, supra omnino *hirta*.—Hep. Bor. Amer. Exsicc. ined., No. 142.—*R. hirta*, Aust. MSS. 1864.

On damp ground in cultivated fields and (the var) in rocky places about Closter, New Jersey, common.

The canal occupies about  $\frac{1}{3}$  of the upper surface of the frond, and has a plane or slightly convex bottom with abrupt sides. That portion of the frond between the canal and the acute margin is slightly convex above as if thickened. The typical form appears to be near *R. paradoxa*, De Not., but that is described as being a smaller species, and the spores are said to be light-red. The var. differs from *R. ciliifera*, Link., in the fronds being purple and more or less scale-bearing underneath, and not membranaceous on the margin. The sporangia are placed rather towards the apex of the lobes as in *R. palmata*, Lindbg.; which appears to be a larger species, with the lobes of the frond concave-canaliculate above, &c., and seems to be intermediate between this and the following species:

*RICCIA LESCHIANA*, Aust. MSS., 1863.

*R. fronde solida subciliata orbiculata stellatim vel subcruciatim divisa incrassata, supra punctato-reticulata glauco vel cinereo-viridi epidermide macula purpurea supra fructum notata, subtus nuda concolore vel demum purpurascente; lacinis bilobis vel di-trichotomis obcordatis lineari-cuneatisve*

## RICCIA SULLIVANTII, Austin MSS., 1863.

*R. terrestris*, velutina, valde cavernosa, fulgida, luteo-viridis; fronde orbiculari celluloso-succulenta radiatim pluries divisa diametro subsemipollicari; laciniis di-trichotomis linearibus (vel in statu juniori subcuneatis) subimbricatis canaliculatis, apice tenuiori angustiori emarginatis, subtus carinato-incrassatis concoloribus nudis (vel ut in *R. fluitante* ob epidermide evanida ad apicem minute squamigerulis), margine undique tenuibus subhyaliniis crispato-undulatis cum serie cellularum singularum hyalinarum circumdatis crennatisque in statu siccati omnino adscendentibus ad apicemque suberectis, carina cavernoso-striata copiose radiculosa ob sporangia subtus tamenti; fructibus copiosissimis e frondis pagina superiori prorumpentibus; sporangiis supra non prominentibus in carina immersis singulatim natis stylo longo nigro coronatis, sporis obscure angularibus reticulatis submuricatis luteo-fuscis vel nigris.—*Hep. Bor. Amer. Exsic. ined.*, No. 147.—*R. crystallina*, Sulliv. Mosses of the U. S. p. 84. pro parte.

On damp or wet ground, in fields and meadows, about Closter, New Jersey; also Pennsylvania, Lesquereux.

*R. Sullivantii* resembles both small forms of *R. crystallina* and terrestrial forms of *R. fluitans*, Linn., but the former is distinguished by its less divided frond with the divisions plane above and expanded towards the apex; and the latter by its divaricate lobes somewhat thickened at the apex, by its fewer and smaller air-cavities, and by its sporangia rupturing underneath the frond, as well as by its shorter style and smoother spores.

[There are occasionally found, imbedded in largish cavities on the under side of the frond, a bundle of rootlets, matted or coiled together. These rootlets are apparently longer than those which fix the plants to the earth, and have the interior surface papillose (a character common to the rootlets of all *Riccia*). Their free end is much expanded and open at the extremity, and towards this extremity they are filled with cubical green bodies, arranged (mostly) in fours, and resembling the spores of a *Conferva*. What these bodies are is doubtful; it is barely possible that they are a sort of reproductive organ belonging to the plant in whose tube-like rootlets they occur.]

## RICCIA TENUIS, Aust.

*R. fronde tenuissima valde cavernosa fibroso-nervosa saturate vel olivaceo-viridi fulgida parce divisa, subtus parcissime squamosa concolore, squamis albidis tenuissimis ligulatis; laciniis rotundo-obovatis (2—4 lin. long.  $1\frac{1}{2}$ —3 lin. lat.) planis, margine sinuato-undulatis, subtus ob costam tenuem anguste carinatis, ad solum radicibus parcissimis tenuissimis affingentibus; fructibus in nervo sitis, sporangiis parvis depresso-globosis plerumque 2—4 aggregatis in frondis pagina inferiori protuberantibus sed e neutra prorumpentibus, calyptra tenuissima laxissime texta frondis substantiam arcte adhærenti stylo brevissimo apice præmorso (non dilatato) coronata, sporis parvis globosis vel subovalibus fuscis valde echinaceo-muricatis.*—*Hep. Bor. Amer. Exsic. ined.*, No. 150.

On wet, broken ground in open woods, near Closter, New Jersey; also near Lawrence, N. J., James.

The closely allied *R. membranacea*, L. & G., differs in the sub-cavernous frond with the lobes suddenly widened and subsulcate towards the apex, in the oblong-rotund sporangia, and longer style dilated at the apex. *R. nigrescens*, Mont., is doubtless also very near our plant, but the margins of the frond are said to be ascending,—furthermore, the description is altogether too meagre.

## RICCIA NATANS, Linn.

The spores of this species vegetate upon mud in summer, and by autumn the young plants become considerably developed: (vide Aust. Hep. Exsic. ined. N. 144, B.; also Lindbg. Monogr. d. Ricc. t. 26, f. 1, under the name of *R.* 1869.)

*lutescens*.) They are suborbicular in outline, lobed and rooting underneath, as in the true terrestrial species. They also have rudimentary scales at the apices of the lobes underneath. These fronds become immersed by the autumn rains, and during the winter the apices of the lobes thicken and expand greatly. These apices being destitute of rootlets and extremely buoyant, gradually assume a vertical position in the bottom of the pool, and at length (in the spring) become detached and rise to the surface of the water, (where they float in a horizontal position,) often carrying with them portions of the effete base of the frond. In the meantime the scales develop into long purple fringes. *These floating apices alone constitute the L. natans of Linnaeus and authors:* (vide Aust. Hep. Exsic. N. 144, A.; also Lindbg. Monogr., p. 115, t. 31 and 32; etc.) They fruit copiously in the vicinity of Albany, N. Y., in the months of May and June (Prof. C. H. Peck). Sometimes the autumn fronds do not become immersed, in this case they remain whole; again the fertile fronds are often left upon the mud by the dessication of the pool in summer; in this case they are plainly continuous from the apex: (vide Hep. Exsic. N. 145; also Herb. Tayl. (in part), under the name of "*Riccia velutina*.—N. Amer. Drummond."

*RICCIA LUTESCENS, Schweinitz.*

A single frond only of this species was found by me in Sept. 1858, at Closter, N. J. This frond contained a single sporangium! which is about as in *R. crystallina*. The spores are also as in that species. During the past eight years I have not only watched this plant in all the stages of its growth, from the time of its first appearance in the month of June, until its final disappearance in winter, but have collected many specimens of it in the mature state. I have also received numerous specimens of it from many localities, from New England to Canada and Missouri; but not a single one of these specimens shows any trace either of fruit or other kind of reproductive organ whatever! and it is still a mystery how the plant reproduces itself. The young plants make their appearance in great profusion, in the bottoms of exsiccated ditches, &c., in the beginning of summer. These rapidly develop into the sterile plant, which has been most accurately described and figured by Mr. Sullivant: (*Mem. Amer. Acad. Arts & Sci. (Boston) 4, p. 176, t. 4.*) No rootlets are produced underneath the frond above the middle; and as the ditches become filled with water late in autumn, the fragile laciniae break asunder near the middle, in consequence of the extreme buoyancy of their apices. The detached pieces (or apices) rise to the surface of the water, where they remain suspended in an oblique position, the extrem. apex only reaching

180 feet in length on Race street, and 65 feet in breadth fronting on 19th street. It is to be fire proof, and it is proposed to construct the walls of green serpentine ornamented with Ohio stone. The estimated cost is about \$125,000, to which we hope an enlightened public, fully appreciating the importance of such an institution as the Academy, will liberally contribute.

The collections of the museum are in their usual condition of preservation, but for want of proper space generally excessively crowded, often partially or totally unarranged, and in some cases in the utmost confusion. The Museum is now too extensive to depend wholly on voluntary labor for its being properly arranged, labeled and catalogued. To accomplish this it is necessary to employ competent persons, and it is to be hoped that before long an effort will be made on the part of the Academy to procure the means essential to the purpose.

The increased attractiveness of the Museum of the Academy, and the almost unrestricted admission of the public, have led to such an increase in the number of visitors as greatly to endanger the condition of the more perishable portions of the collection. During the year the Museum, though open to the public only two afternoons weekly, and though closed during August for cleansing and repairs, was visited by nearly 100,000 persons. In a single afternoon recently there were upwards of 4,500 persons admitted to the Museum. In consequence of the very small amount of unoccupied room the visitors move in nearly continued streams through the narrow intervals of the cabinets, affording little opportunity for the examination of specimens. Beside this disadvantage to those who would really wish to examine the collections, the crowds lead to many accidents, the sum total of which amounts to a considerable destruction of property, in the way of broken glass, light wood work, &c. Further, the excessive clouds of dust produced by the moving crowds, rest upon the horizontal cases, obscuring from view their contents, while it penetrates others much to the detriment of parts of the collection. An annoyance arising from the great number of visitors is due to the necessity of having tickets of admission, provided gratuitously from members of the Academy or from agents authorized to issue them by the Curators.

In view of all these annoyances, inconveniences and detriment to the Museum, attendant on an excessive number of visitors, the Curators would suggest to the Academy the propriety of making a small charge for admission, as the best means of qualifying or removing the various difficulties indicated.

The Curators recommend the charge of a small fee, say ten cents, which will probably be sufficient to moderate the crowds of visitors, and at the same time will be no obstruction to those who are desirous of seeing the Museum. Of course it is not intended to restrict the right of members to visit the Academy in company with their friends at any and at all times according to their convenience.

The donations during the year, to the different departments of the Museum, are as follows:

*Mammals.*—Two skins and the skeleton of a Lemur, together with the skins of several other mammals from Port Natal, Africa, were presented by the Rev. S. A. Grout. Five other mammals were presented by Dr. James M. Green, U. S. N., Prof. S. D. Gross, George Davidson and John Krider.

*Birds.*—A special report, on the condition of the ornithological cabinet, has been prepared by the standing committee and is appended to the present one.

Two collections of bird skins from San Domingo, were presented by Wm. M. Gabb; another from Port Natal by the Rev. S. A. Grout; and a collection from St. Martins, W. I., by Dr. H. E. van Rijgersma. A mounted specimen of the Golden Eagle was presented by Frank L. Altemus; a *Lophophorus impeyanus* from Asia, by the Rev. J. L. Scott; and a small collection of birds, in alcohol, from South America, by Prof. E. D. Cope. Specimens of birds were also presented by John Krider, Harvey E. Molé, W. P. Turnbull,

[1869.

Mr. Haines and D. G. Elliot. A small collection of bird eggs, from Sable Island, was presented by J. B. Willis.

*Reptiles.*—A collection of fifteen species from Africa, thirteen from Asia, and nine from Australia, together with five jars of specimens from Uruguay, one jar from New Grenada and other specimens from South America were presented by Prof. E. D. Cope. Two small collections, comprising eighteen species from San Domingo, were presented by Wm. M. Gabb. A small collection from St. Martins, W. I., was presented by Dr. Rijgersma; another from Port Natal, by Rev. S. A. Grout; and three jars from Venezuela, by L. Morgan Davis. Specimens were likewise presented by George Davidson, Dr. Hassler, L. P. Whiting, Capt. J. Barclay, John Krider, Joseph Jeanes and Joseph A. Damon.

*Fishes.*—Two collections, one of forty-one specimens of twenty-five species, and another of many specimens of sixteen species, from St. Martins, W. I., were presented by Dr. R. E. van Rijgersma of Philipsburg, St. Martins, W. I. Other specimens were presented by Mr. Gabb, A. H. Smith, Dr. I. Hays, Dr. Howel and Jos. Jeanes.

*Mollusks.*—For the principal donations we refer to the report of the Conservator of the Conchological Section of the Academy.

In addition there were presented two species of cephalopods by Dr. Rijgersma, and small collections of shells by Wm. M. Gabb, Rev. S. A. Grout, Dr. Leconte and S. Powel.

*Articulates.*—Two collections, comprising seventy specimens of crustaceans, two jars of spiders and one of insects from St. Martins, W. I., were presented by Dr. R. E. van Rijgersma. A collection of myriapods and insects from Port Natal, W. A., was presented by Rev. S. A. Grout; and a jar of myriapods, arachnides and insects from Lower California, by Alfred DuBois. Specimens of crustacea were also presented by George Davidson and Dr. F. A. Genth.

*Radiates, &c.*—A collection of twelve asterioids, six corals, a large Gorgonia and five species of sponges, from St. Martins, were presented by Dr. Rijgersma. Six species of Echini and Ophiura and a Madrepora, from San Domingo, were presented by Wm. M. Gabb. Several corals were presented by Dr. Hassler, several radiates by S. Powel, and two specimens of Euplectella by the latter and Mr. Crawford Coates.

*Fossils.*—An additional portion of the Poirrier collection, of vertebrate remains from the miocene and post pliocene formations of the basin of the Loire France, was presented at the expense of Messrs E. S. Whelan, Richard

cean bones were presented by the latter and C. W. Matthews. Other fossil specimens were presented by Col. James Greer, Wm. M. Gabb, Mr. Hornbush, W. Morrison, A. H. Smith, Dr. J. Leconte, T. H. Streets, T. Guilford Smith, Enoch L. Johnson, Louis Godey, P. T. Tyson and George Davidson.

*Minerals.*—A small collection was presented by T. Guilford Smith. Specimens were also received from Alexander E. Dougherty, J. Blodget Britton, C. W. Matthews, Joseph Wilcox, J. Lawrence Smith, Isaac Lea, John L. LeConte, George Davidson, T. D. Rand, P. W. Sheaffer, Capt. J. Barclay, Mr. Tyson, W. McKee Mason, W. L. Mactier and Joseph Leidy. A few others were also obtained in exchange.

*Botany.*—A series of Junci representing the monograph of Dr. Engleman, and a series of Potamogeton, collected by Dr. J. W. Robbins, were presented by Mr. E. Durand. A rare fern was presented by Mr. Redfield.

*Comparative Anatomy.*—A skull of *Hyperaodon bidens* and other portions of the skeleton, from Newport R. I., were presented by Samuel Powel. An artificially elongated human skull from the vicinity of Lake Titicaca, Bolivia, was presented by Dr. J. M. Greene, U. S. N. A collection of bones of the Bison, Wolf, Deer, &c., was presented by Prof. Hayden. Remains of Indian skeletons were presented by Prof. Cope; the jaw of a Dolphin and several teeth of the Sperm Whale, by Dr. Rijgersma, and portions of human muscles with *Trichinæ*, by Dr. J. S. Hough.

*Miscellaneous.*—Nine jars of vertebrates from St. Martins, W. I., were presented by Dr. Rijgersma. Seven specimens were presented by Prof. S. D. Gross, and several by unknown donors.

Respectfully submitted by

JOSEPH LEIDY,

*Chairman of the Curators.*

## REPORT OF THE ORNITHOLOGICAL COMMITTEE.

The Committee begs leave to report that the following named donations to the collection of birds have been made during the year 1869 :

*March.*—2 specimens of *Lagopus mutus*, 1 specimen of *Lagopus islandorum*, presented by D. G. Elliott. 1 specimen of *Accipiter Cooperii*, presented by Mr. Haines.

*April.*—A specimen of *Aythya Americana*, (variety), 1 specimen of *Corvus Americanus*, (albino), 1 specimen of *Cairina moschata*, 1 specimen of *Gracula musica*, presented by Jno. Krider. 2 specimens of *Picus albolarvatus*, ♂ ♀ presented by Wm. P. Turnbull. 1 specimen of *Lophophorus impeyanus*, ♂ presented by J. L. Scott.

*May.*—Sundry specimens in alcohol, presented by E. D. Cope. 1 mounted specimen of *Larus argentatus*, presented by H. E. Molé. 6 mounted specimens (5 species) of birds from St. Martins, W. D., presented by H. E. Van Rijgersma.

*July.*—A mounted specimen of *Aquila chrysaetos*, presented by F. L. Altemus. And a collection of skins from Port Natal, Africa, presented by S. A. Grout.

*August.*—Collection of 30 specimens of skins from St. Domingo, presented by Wm. M. Gabb.

*October.*—Collection of eggs from Sable Island, presented by J. R. Millis.

*December.*—21 specimens of skins from St. Domingo, presented by Wm. M. Gabb.

The Committee would further state, that since last spring the work of over-1869.]

looking and poisoning the entire collection of birds has been going on, and is now nearly completed. Almost every mounted bird has been examined, disinfected and the cases cleaned. It was found that there was no time to lose in this work, as many specimens had been attacked by insects, and further delay might have occasioned the loss of a portion of our collection which could probably never be replaced. The remaining cases will soon be gone through.

The Committee cannot too strongly urge the necessity of such an examination being made, if not *annually*, at least once in two years, even should it involve some expense to the Academy to secure the preservation of the best collection of birds on this continent, and, with one exception, the largest in the world.

By permission and special vote of the Academy, a duplicate specimen of the rare egg of the Great Auk (*Alca impennis*) was presented to the Smithsonian Institution at Washington. In addition to some rare and valuable bird skins this Institution intends giving us from late expeditions to Alaska and the North-West, there is being made up for this Academy a collection of eggs, many of value and interest, procured mostly from Arctic America. But we are badly off for a place to put them, the present cabinets of eggs being nearly full and in too dark a room to be of any use for study. We would, therefore, ask that some appropriation be made for additional cabinets, and also that the whole be placed in a more suitable part of the building.

The Committee recommends that permission be given to sell (or exchange) the *duplicate* bird skins packed away in chests and drawers, some now injured by insects, and which, in a few years, may become seriously damaged; the proceeds of such sales to be appropriated to the purchase of specimens wanted, and that might be procured in this way, and especially of newly discovered species, our additions to which, for the last five or six years, have been far behind other Ornithological Museums in this country and elsewhere, and consequently has brought our collection to a comparative stand still.

The Committee would also call attention to that portion of the Library devoted to Ornithology. Since the death of the late Dr. Wilson, only such books on the subject then going on in parts, and for which he made appropriation, have been continued, thereby causing some leading periodicals and other works to be dropped, thus impairing the value of the whole as a Library of reference. Very many important books published during the last few years are wanted, and to keep up with the present state of Ornithological Science throughout the world, it is necessary that students should be able to refer to the latest and best authors.

Respectfully submitted.

BERNARD A. HOOPER, *Chairman.*

tion, 1 ; Navy Department, 1 ; L. H. Morgan, 1 ; Dr. Hassler, 1 ; Sanitary Commission, 1 ; Dr. H. C. Wood, Jr., 1 ; in exchange, 1 ; Don Rafael Arango, 1. Total, 1131.

And were divided as follows :

Journals, 798 ; Conchology, 149 ; Geology, 46 ; General Natural History, 46 ; Botany, 21 ; Ornithology, 20 ; Bibliography, 9 ; Entomology, 8 ; Anatomy and Physiology, 7 ; Herpetology, 6 ; Physical Science, 5 ; Helminthology, 5 ; Mineralogy, 3 ; Voyages and Travels, 3 ; History, 3 ; Chemistry, 2.

Of these 10 volumes and 91 pamphlets were received through the Conchological Section.

The duplicate works which have accumulated from time to time have been catalogued, priced and packed, preparatory to sending them to Wm. Wood & Co., of New York, for sale. Selections from these duplicates to the value of \$150.00 have been exchanged by the Library Committee for a copy of Elliot's Birds of North America.

During the year the books in the Conchological Department have been newly catalogued and numbered. The latter arrangement has been productive of all the good results anticipated, and demonstrates the necessity of extending the same system of numbering throughout the entire library, at as early a date as possible.

All of which is respectfully submitted.

EDW. J. NOLAN, *Librarian.*

## REPORT OF THE RECORDING SECRETARY.

During the year ending November 30th, 1869, there have been elected thirty-three members and eleven correspondents.

The death of the following members and correspondents have been announced.

Five members, namely : Mr. John Cassin, Mr. Chas. N. Bancker, Mr. Jason L. Fenimore, Dr. Chas. D. Meigs, Mr. Fred. Klett.

Four correspondents, namely : Frederick Cailliaud, Herman Von Meyer, Mr. George J. Durham, Dr. T. H. Turner, U. S. A.

The number of papers contributed and ordered to be printed in the Proceedings and Journal during the year has been thirty-six, as follows :

In the Proceedings thirty-three, namely :

Prof. Joseph Leidy.....	2	Prof. E. D. Cope.....	7
F. B. Meek & A. H. Worthen.....	5	Thomas Meehan .....	4
George N. Lawrence.....	1	Elliott Coues.....	1
Dr. John L. LeConte.....	3	Isaac Lea.....	3
John Cassin.....	1	Capt. C. M. Scammon (edited by	
Jacob Ennis.....	1	E. D. Cope).....	1
Dr. W. W. Keen.....	1	Dr. C. Johnson.....	1
Robert Ridgway.....	1	Dr. J. G. Richardson.....	1

In the Journal three, namely :

J. Barnard Davis, 1 ; Alphonzo Wood, 1 ; Jos. Leidy, including all the Nos. of Vol. 7.

There were four papers recommended to be printed in the American Journal of Medical Sciences, namely :

Dr. William Pepper.....	1	Dr. Christopher Johnson.....	1
Dr. James Tyson.....	1	Dr. S. W. Mitchel.....	1

One paper to be published in a Medical Journal to be selected by the author, Dr. J. G. Richardson.

There were four papers withdrawn by their authors, namely :

E. D. Cope, papers 165, 179 and 180.

Mr. Cassin's paper No. 168, withdrawn by Mr. B. A. Hoopes.

All of which is respectfully submitted.

SAMUEL B. HOWELL, *Recording Secretary.*

## REPORTS OF THE CONCHOLOGICAL SECTION.

## RECORDER'S REPORT.

During the year ending Dec. 2d, 1869, there have been elected one member and three correspondents.

One member has resigned.

Papers have been accepted for publication in the Journal, by the following authors :

T. A. Conrad,.....	5	John H. Redfield.....	1
G. W. Tryon, Jr.....	9	S. R. Roberts.....	1
W. M. Gabb.....	5	Theo. Gill, M.D.....	1
W. Harper Pease .....	3	W. H. Dall.....	1
Jas. Lewis, M.D.....	2	Ralph Tate.....	1
Temple Prime.....	1	Wesley Newcomb, M.D.....	3
Binney and Bland.....	1	J. G. Cooper, M.D.....	2

Respectfully submitted,

S. R. ROBERTS, *Recorder*.

## CORRESPONDING SECRETARY'S REPORT.

*To the Conchological Section of the Academy of Natural Sciences, Philadelphia :*

The Corresponding Secretary would respectfully report that letters have been forwarded and received as follows, viz. :

1868. Dec. 31.—To Dr. Leopold von Schrenck, St. Petersburg, with publications.

1869. Jan. 5.—To Hugh Nevill, F.R.A.S., Galle, Ceylon, accepting proposals for exchange.

May 13.—To Luigi Benoit, Messina, letter of acknowledgement.

May 21.—To Dr. H. E. v. Rijgersma, St. Martins, W. I., soliciting collections.

To W. B. Pryor, Esq., Shanghai, China, soliciting collections.

June 11.—To Prof. Joseph Henry, Smithsonian Institution, soliciting publications.

June 22.—To the Société Malacologique de Belgique, Bruxelles, exchange of publications.

To E. A. Bielz, Hermanstadt, Transylvania, exchanges.

To the Société Malacologique de Paris, Paris, for exchange of publications.

May 6.—B. Westermann & Co, New York, publications.  
 S. L. Abbott, Boston, with publications.  
 E. C. Bolles, Portland, Me., acknowledgment of publications.  
 Leon Vaillant, Paris, acknowledgement of election.  
 Philip Lutley Sclater, London, acknowledgment of publications.  
 L. Chenu, Paris, acknowledgment of election.  
 Prof O. A. L. Mörch, Copenhagen, with paper for publication.  
 May 12.—Luigi Benoit, Messina, acknowledgment of case of shells.  
 August 5.—D. C. Gentiluomo, Pisa, exchange of publications.  
 Oct. 16.—Sylvanus Hanley, Middlesex, Eng., with case of shells.  
 E. A. Bielz, Hermanstadt, with publications.  
 Oct. 29.—W. A. Pryer, Shanghai, China, information as to collecting shells.  
 All of which is respectfully submitted.  
 Philad., Dec. 1, 1869.

E. R. BEADLE, *Corres. Sec'y.*

### LIBRARIAN'S REPORT.

The Librarian respectfully reports that there have been presented during the past year to the library of the Conchological Section 10 volumes, 91 pamphlets and one map. Of these 34 were received from authors, 20 from editors, 30 from Societies, 5 from the Publication Committee, 1 from Wm. M. Gabb, 1 from Don Rafael Arango, 10 from George W. Tryon, Jr., and one from the Smithsonian Institution.

In addition, thirty-two pamphlets, volumes and continuations of Conchological works have been received through the Academy.

During the year the Catalogue has been carefully revised, and the books numbered, with the effect of greatly lessening the labor of those referring to them.

EDW. J. NOLAN, *Librarian.*

### CONSERVATOR'S REPORT.

The Conservator of the Conchological Section respectfully reports that the donations to the Cabinet during the year have been as follows:

From ISAAC LEA. Nineteen species of *Unionidae* from Ouachita, Arkansas, *Chamostrea albida*, Roissy, with oscicle, from New South Wales, and twelve species of shells from the island of Andaman, Bay of Bengal.

E. R. BEADLE. Three species of *Unio*, *Auricula aurismida*, Lin., and two unknown species from Asia; also a *Trochus* from the West Indies, and *Trivia sulcata*, Dillw.

JOHN FORD. Seven specimens of *Busicon aruanum* from Atlantic City, fine specimens of *Natica heros* from Brigantine Beach, N. J., and types of *Astarte subignea*, Ford.

F. V. HAYDEN, M.D. Numerous specimens of *Helix Cooperi*, Bland, and *H. Haydeni*, Gabb, from Weber Canon, near Salt Lake City.

GEORGE W. TRYON, JR. Eleven species from O. A. L. Mörch, of Copenhagen.

J. L. LECOMTE. Type specimens of five species of *Melania* described by Isaac Lea.

WM. M. GABB. Eleven species of *Unio* from Central America and twenty-four species of land shells from San Domingo, personally collected, including several undescribed species.

RALPH TATE. Seventy-seven species, numerous specimens of land and fresh-water shells from Central America, Venezuela, Guayana and Nicaragua, including types of several new species described in our Journal; also nineteen species of land shells from Venezuela and the island of San Lucia, W. I., mostly undescribed.

1869.]

- W. H. PHASE. Seventy-nine species of marine shells from the Polynesian Seas, including types of new species.
- R. E. O. STARNES. Sixty-four species of marine, fresh water and land shells, principally from California, Oregon, South Carolina and Florida, and seven species from Tampa Bay.
- F. A. HASSLER, M.D. Fine specimen of *Marginella carnea*, Storer, fine series of *Limnæa columella*, and embryos of *Vivipara Nolani* and *Busycon carica*.
- W. H. DALL. Five species of *Lepitida*, types of descriptions published in the Journal.
- W. S. W. RUSCHENBERGER. Two hundred and twenty-seven species, principally marine mollusca, personally collected by the donor.
- DR. J. C. COX. Two hundred and twenty-three species land, fresh-water and marine shells of Australia, New Caledonia and adjacent islands, including types of many new species.
- W. H. PHASE. Sixty-three species of marine shells from the Polynesian seas, including types of new species published in the Journal.
- CHICAGO ACADEMY OF NATURAL SCIENCES. Thirty-four species of Japanese mollusca, collected by F. Bischoff.
- REV. ALDEN GROUT. Eight species of land shells from Port Natal.
- SMITHSONIAN INSTITUTION. Five hundred land, fresh-water and marine shells, carefully named by Mr. P. P. Carpenter.
- LUIGI BENOIT. One hundred and eighty-six species of land shells from Sicily, including types of most of his descriptions.
- J. H. THOMSON. *Cyprea picta*, *C. sonata*, *C. annulus*, *C. obvelata* and *C. Beckii*; *Trivia candidula* and *T. pulex*.
- SYLVANUS HANLEY. Four hundred and four species of land, fresh-water and marine shells, principally European, but including a number of rare East Indian shells, some of them undescribed.
- PAUL TERVEER. One hundred and seventy-six species of European land and fresh-water shells.
- Smaller collections have been received from Gabriel Duqu6, E. H. Jenks, Prof. J. Powell, Edw. D. Cope, G. A. Lathrop, Mrs. Lewis, Dr. Jos. Leidy, O. W. Peale, Dr. James Lewis, Dr. Samuel Lewis, A. H. Smith, John Wolf, J. R. Willis, Dr. Harrison Allen and W. L. Mactier.

The number of species presented during the year amounts to about 2150,

The election of Officers for the ensuing year was held, in accordance with the By-Laws, with the following result :

<i>President</i> .....	W. S. W. RUSCHENBERGER, M.D.,
<i>Vice-Presidents</i> .....	Wm. S. Vaux, Jos. Carson, M. D.
<i>Corresponding Secretary</i> .....	Edw. D. Cope.
<i>Librarian</i> .....	Edw. J. Nolan, M. D.
<i>Treasurer</i> .....	Wm. C. Henszey.
<i>Curators</i> .....	Jos. Leidy, M. D., Wm. S. Vaux, Geo. W. Tryon, Edw. D. Cope.
<i>Council</i> .....	Isaac Lea, Isaac Hayes, M. D., Robert Bridges, M. D., Edw. S. Whelen.
<i>Publication Committee</i> .....	Jos. Leidy, M. D., Robt. Bridges, M. D., Wm. S. Vaux, Jas. Tyson, M. D., Edw. J. Nolan, M. D.
<i>Committee on Finance</i> .....	Robt. Bridges, M. D., Wm. S. Vaux, A. H. Smith.
<i>Recording Secretary</i> .....	S. B. Howell, M. D.

## ELECTIONS FOR 1869.

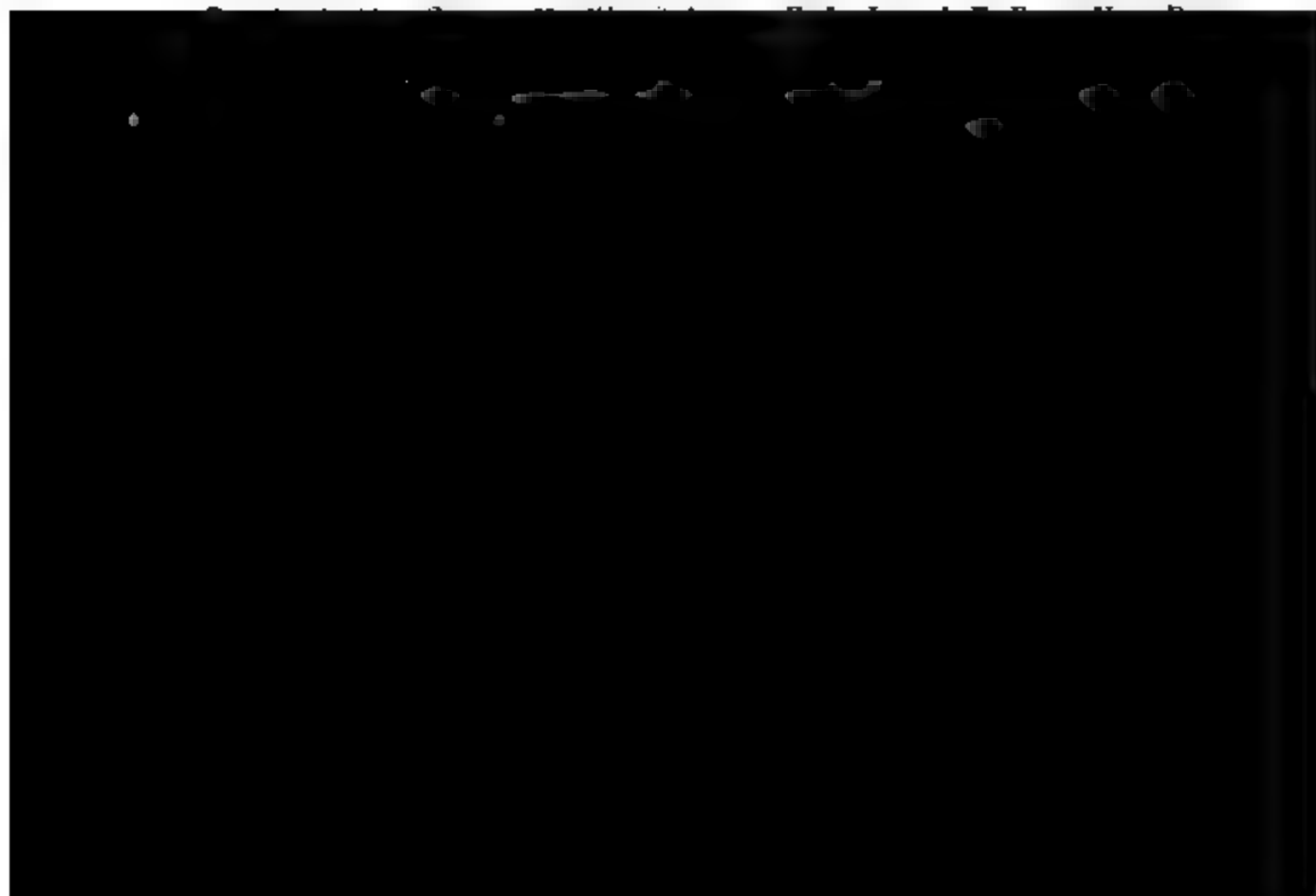
---

Members and Correspondents of the Academy of Natural Sciences have been elected as follows for the year 1869 :

### MEMBERS.

- Dec. 29, 1868.*—Albert Peale, Edw. A. Spooner, M. D., Franklin Platt, Jr.  
*Jan. 26, 1869.*—William M. Wilson, Caleb S. Hallowell, R. J. Levis, M. D.  
*Feb. 23.*—Hector Tyndale, Theodore Cuyler, William Dulty, Charles Morris.  
*March 30.*—John Birkinbine, James Greer, Dayton, O., Douglass R. Bannan, M. D., U. S. N., George C. Henszey.  
*April 27.*—Isaac S. Fogg, J. S. Withron, John O. Sinclair.  
*June 29.*—N. Roe Bradner, M. D.  
*April 27.*—Henry Bower.  
*May 25.*—William B. Corbit, William Rudder, Persifor Frazer.  
*June 29.*—Harry Emlen, Charles B. Nancrede, M. D.  
*Sept. 28.*—Thomas H. Streets, Smyrna, Del., Nathaniel G. Macomber.  
*July 29.*—Chas. L. Cassin, M. D., U. S. N.  
*Aug. 31.*—John C. Spear, M. D., U. S. N., James Lanman Harmar, Fausto E. Rendon, M. D., Guayaquil.  
*Sept. 28.*—W. H. Finn, M. D.  
*Nov. 30.*—Henry C. Miller, Z. M. Humphrey.  
 Number of members elected in 1869..... 33

### CORRESPONDENTS.



## CORRESPONDENCE OF THE ACADEMY, For 1869.

---

*January.*—Dr. C. A. Martius, announcing the death of Herr Dr. Carl Friedrich Philipp von Martius.

William M. Darlington, acknowledging receipt of notice of election as member.

J. S. Wilson, acknowledging receipt of notice of election as correspondent.

John R. Willis, with collection of fishes forwarded.

R. Osten Sacken, asking that a wood cut be sent to A. S. Packard.

Joseph F. Berg, acknowledging receipt of notice of election as correspondent.

James Orton, acknowledging receipt of birds sent.

Wistar Morris, with check for \$100, and making suggestions in regard to the location of the proposed new building.

A. J. Morrison, returning thanks for permission to visit museum.

Elias Lewis, Jr., asking permission to visit museum and library.

H. V. Poiziez, in regard to sale of a collection of specimens.

Thos. Earkins, in regard to collection shipped from France.

John Tones ;

A. Milne Edwards ;

Samuel Haughton ;

T. Spencer Cobbold ; severally acknowledging receipt of notice of election as correspondent.

Royal Society of Edinburgh ;

Société Royale des Sciences à Upsal ;

Académie Royale des Sciences à Amsterdam ; severally acknowledging receipt of Journal and Proceedings.

Institut Impérial de France ;

Bibliotheca Universitatis Lugduno-Batavæ ; each acknowledging receipt of Journal and Proceedings, and asking that deficiencies be supplied.

Société de Physique et d'Histoire Naturelle de Genève ;

L'Université Royale de Norvège à Christiania ; each with publications, and also acknowledging receipt of Journal and Proceedings.

Smithsonian Institution ;

Die Gesellschaft für Beförderung der Naturwissenschaften zu Freiburg ;

Die Naturforschende Gesellschaft des Osterlandes zu Altenburg ;

Die Naturforschende Gesellschaft zu Basel, Switzerland ;

Naturforschende Gesellschaft zu Halle ;

Bataafsch Genootschap der Proefondervindelijke Wijsbegeerte te Rotterdam ;

Die Königliche Gesellschaft der Wissenschaften zu Göttingen ;

Museum at Bergen, Norway ;

Royal Society of Northern Antiquities at Copenhagen ;

City Library at Hannover ;

Königlich Preussischen Akademie der Wissenschaften ;

Die Naturforschende Gesellschaft zu Freiburg Leopoldino-Carolinische Deutsche ;

Académie der Naturforscher ;

Académie Royale des Sciences à Amsterdam ;

Société Royale des Sciences à Upsal ;

Der Naturforscher Verein zu Riga ;

Société Hollandaise des Sciences à Harlem;  
 Musée public de Buenos Aires;  
 Kaiserliche Akademie der Wissenschaften;  
 Fürstlich Jablonowskischen Gesellschaft zu Leipzig;  
 Société Hollandaise des Sciences à Harlem;  
 Königliche öffentliche Bibliothek zu Dresden; severally acknowledging receipt of Proceedings.

Prof J. Henry, with specimens for microscopic examination.

Institut Royal Météorologique des Pays-Bas, acknowledging receipt of donation to library.

F. A. Randall, in regard to shells left at the Academy.

Henry Woodard, in regard to paying for fossils.

D. Lindley, with box of specimens sent.

B. Waterhouse Hawkins, acknowledging receipt of resolutions.

Kgl. Norske Universitet Christiania, asking for a duplicate set of the Academy's publications.

*February.*—Der Naturwissenschaftliche Verein für das Fürstenthum Lüneburg;

Edinburgh Geological Society;

Gesellschaft Naturforschender Freunde zu Berlin; severally with publications.

J. S. Latimer;

A. A. Breneman;

W. Kitchen Parker;

Dr. H. E. van Rijgersma; severally acknowledging receipt of notice of election as correspondents.

Lyceum of Natural History;

Surgeon-General's Office;

Library of Essex Institute;

K. K. Zoologisch-botanische Gesellschaft in Wien;

Verein für vaterländische Naturkunde in Württemberg;

Smithsonian Institution; severally acknowledging receipt of Proceedings.

E. B. Worthington, wishing to purchase glass eyes for bird skins.

F. W. Putnam, declining to print paper, etc.

A. S. Bickmore, asking for a lecturer.

C. T. Seiss, asking information in regard to membership.

C. Hering, asking for a specimen.

A. Boucard, offering to send specimens of insects, etc.

- Samuel Powell, calling attention to a magic lantern.  
 Andrew Sherwood, offering to collect for the Acad. Nat. Sci.  
 Herman Poole, in regard to the formation of a Natural History Society in Cornell University.  
 Geo. T. Knight, giving information of a collection for sale.  
 W. B. Pryer, in regard to collections at Shanghai.  
 J. E. LeCompt, in regard to Fin-back whale.  
 A. Horner, Jr., resignation of membership.  
 J. W. Dawson, with specimens for museum.  
 A. S. Bickmore, inquiring for Prof. Ebell.  
 Université Catholique de Louvain, acknowledging receipt of Journal and Proceedings.  
 Gesellschaft der Wissenschaften, with publications, and acknowledging receipt of Journal and Proceedings.  
 April.—Académie Royal des Sciences, des Lettres et des Beaux-Arts;  
 Société Entomologique de France;  
 Boston Society of Natural History; severally with publications.  
 Société Impériale des Naturalistes de Moscou;  
 Société Liennéenne de Bordeaux; each acknowledging receipt of Journal and Proceedings.  
 Prof. Henry, in regard to skeletons of Batrachia, etc.  
 Geo. Neville, acknowledging receipt of notice of election as correspondent.  
 Wm. M. Wilson, acknowledging receipt of notice of election as member.  
 Carrington & Co., in regard to sending freight to the Amazon.  
 Fred. Franck, in regard to sending freight to St. Domingo.  
 Wm. C. Henszey, Treas., with list of members who have paid initiation fee.  
 Auguste F. Müller, in regard to Expedition to the Amazon.  
 E. P. Borden, in regard to bark "Trinity."  
 Jos. Jeunes, resignation of position as auditor.  
 Société des Sciences, Physiques et Naturelles de Bordeaux, asking for missing numbers of publications of Acad. Nat. Sci.  
 May.—Lyceum of Natural History;  
 Portland Society of Natural History;  
 Hof und Staatsbibliothek München; each acknowledging receipt of Proceedings.  
 K. B. Akademie de Wissenschaften, acknowledging receipt of Journal and Proceedings.  
 Smithsonian Institution, with collection of birds from Alaska.  
 Mrs. Willard Parker, in regard to box sent to the Acad. Nat. Sci.  
 John J. Lawson, Sr., in regard to the skeleton of a whale.  
 Prof. Baird, in regard to monograph on Cetacea.  
 Jas. Orton, in regard to Huxwell's collections.  
 Zool. Botan. Gesellschaft zu Wien, asking for missing numbers of the publications of the Acad. Nat. Sci.  
 Albany Hancock, acknowledging receipt of notice of election as correspondent.  
 B. Waterhouse Hawkins, acknowledging receipt of notice of election as member.  
 C. S. West, announcing the death of Geo. J. Durham, a correspondent of the Acad. Nat. Sci.  
 Manchester Scientific Students Association, with publications.  
 Antonio Stoppani, announcing the death of Abbe Joseph Stabile, a correspondent of the Academy.  
 June.—Schweizerische Gesellschaft, Bern;  
 Naturforschende Gesellschaft zu Bamberg;  
 Der Naturforscher-Verein zu Riga;  
 Naturforschende Gesellschaft in Bern; severally acknowledging receipt of Proceedings.

Société Impériale d'Agriculture de Lyon, with publications, and asking for missing numbers of the publications of the Acad. Nat. Sci.

Naturforschenden Gesellschaft in Bern, with publications.

L'Académie Royale Suedoise des Sciences, Stockholm, with publications, and asking for missing numbers of Journal.

John Speechey Golch, in regard to making collections in Australia.

Chris. Rünnebaum.

*July.*—Smithsonian Institution. Magyar tudományos Akadémia, with donation to Library.

New York State Library;

Surgeon Gen. Office, War Dept. U. S.;

Académie Royale des Sciences de Belgique, severally acknowledging the receipt of Proceedings.

Boston Society of Natural History, acknowledging receipts of Journal and Proceedings.

L. J. Deal, with resignation of J. J. Stephenson's membership.

Smithsonian Institution, thanks for egg of Great Auk.

Public Library of Boston, acknowledging receipts of two pamphlets.

Dr. J. S. Billings, asking to borrow books.

Harry Emlen, acknowledging receipt of notice of election as a member.

*August.*—Essex Institute, acknowledging receipt of Proceedings.

Akademie der Wissenschaften, Berlin;

Naturhistorischer Verein in Augsburg;

Naturforschende Gesellschaft zu Halle, severally with publications.

Literary and Philosophical Society of Manchester with publication, and asking for missing numbers of publications of Acad. Nat. Sci.

Société de Physique et d'Histoire Naturelle de Genève with publication, and acknowledging receipt of Journal and Proceedings.

Geo. H. Cook, in regard to bones of Mosasaurus.

Vanderhorst & Boegler, package received from Holland for Acad. Nat. Sci.

Jas. Backhouse, in regard to naturalist in Australia.

D. H. Storer, in regard to report on fish of Massachusetts.

Chas. L. Cassin, M.D.;

Wm. B. Corbit, each acknowledging receipt of notice of election as member.

J. A. McNiel, Prof. Henry, O. C. Marsh, O. N. Bryan.

*September.*—Naturforschende Gesellschaft in Zürich, acknowledging receipt of Proceedings.

H. W. Hollowbush, in regard to minerals.

J. Aitken Meigs, with address of F. E. Randon, M.D.

J. C. Spear, acknowledging receipt of notice of election as member.

Geo. Davidson, with specimens sent Acad. Nat. Sci.

Naturforschende Verein in Brünn, acknowledging receipt of Proceedings and sending publication.

J. H. Blake ;

J. A. Allen, each acknowledging receipt of paper on Cetacea.

E. N. Horsford, in regard to six-toed cat.

Vanderhorst & Boegler, in regard to package from Holland.

John T. Morris, invitation to see freezing apparatus.

A. M. Boyd, in regard to sending specimens.

Dr. J. T. Boynton.

J. R. Willis, asking that diploma be sent.

Thos. Meehan, with address of Dr. Müller.

E. D. Bassett, in regard to collections in Hayti.

T. W. Hoyt, asking for copy of Constitution.

A. E. Verrell, in regard to Chinese reptiles.

B. F. Mudge, in regard to fossils in Kansas.

Dr. H. E. van Rijgersma, in regard to collections in St. Martins.

H. W. Hollowbush, in regard to fossil wood.

S. G. Macomber, acknowledging receipt of notice of election as member.

*November.*—New York State Library ;

Library of Congress, each acknowledging receipt of Journal.

J. W. Dowsing, M.D., offering to collect for Acad. Nat. Sci.

Wm. Smith, asking in what way he can serve the Acad. Nat. Sci.

Jas. Orton, asking in regard to specimens.

Edward Hitchcock, offering to lend fossil bones.

J. N. Joclyn, in regard to "Nature."

J. P. Peck, in regard to white fish.

J. A. Hauxwell, in regard to making collections.

W. H. Finn, M.D., acknowledging receipt of notice of election as member.

G. A. Williams, in regard to an exchange of specimens.

*December.*—Prof. Edward Hitchcock, with box of specimens.

F. W. Packard, in regard to the McNeil reptiles.

J. A. Allen, offering to send paper on Massachusetts Mammalia.

Prof. Henry, asking the return of skulls belonging to Smithsonian Institution.

Schweizerisch Naturforschender Gesellschaft Bern, with publication.

Christine Hood, in regard to six-toed cat.

J. A. Allen, with copy of paper.

G. H. Lawson, asking information in regard to the Acad. Nat. Sci.

Whole number of letters received during 1869, 218.

\* " " " written " " 137.

EDWARD D. COPE,

*Corresponding Secretary.*

\* Number of letters written in 1868 and not printed with the report last year, 153.

## DONATIONS TO THE LIBRARY.

1869.

## JOURNALS AND PERIODICALS.

## SWEDEN.

- Stockholm. Öfversigt af K. Vetenskaps-Akademiens Förhandlingar. Vols. 22—25. 1865—1868. From the Society.  
 Kongliga Svenska Vetenskaps Akademiens Handlingar. Ny Följd, 1866—1867. From the Society.  
 Lefnadsteckningar öfver K. S. Vetenskaps Akademiens efter år 1862 Aflidna Ledamöter. Band I, Häfte 1, 1869. From the Society.  
 Upsal. Nova Acta Regiæ Societatis Scientiarum, Upsaliensis. Seriei Tertie. Vol. VI, Fasc. 2, 1868. From the Society.

## NORWAY.

- Christiania. Förhandlingar i Videnskabs-Selskabet i Christiania, Aar 1867—1868. From the Society.  
 Registre til Christiania Videnskabs selskabs Förhandlingar. 1858—1867. From the Society.  
 Nyt Magazin for Naturvidenskaberne. Vols. 1—15. 1837—1863. From the Royal Norwegian University.  
 Norsk Meteorologisk Aarbog for 1867, 1868. From the Meteorological Society.  
 Meteorologiske Jagttagelser paa Christiania Observatorium, 1867 and 1868. From the Observatory.  
 Tre Akademiske Taler paa Universitets Aarsfest den 2den September af M. J. Mourad. 1863. From the Society.  
 Det K. Norske Frederiks Universitets aarsberetning for Aaret 1867 med Bilage. 1868. From the University.

## DENMARK.

- Kiøbenhavn. Oversigt over det K. l. Videnskabernes Selskabs Förhandlin-

**Moscow.** Bulletin de la Société Impériale des Naturalistes de Moscou. Année 1868. Nos. 1, 2 and 3. From the Society.

**Riga.** Arbeiten des Naturforscher-Vereins zu Riga. Neue Folge. 2es Heft. From the Society.

**St. Petersburg.** Bulletin de l'Académie Impériale des Sciences de St. Petersburg. Tome XIII. Nos. 1—4. From the Society.

Mémoires de l'Académie Impériale des Sciences de St. Petersburg. Tome XII, No. 1, to Tome XIV, No. 2. From the Society.

## HOLLAND.

**Amsterdam.** Verhandelingen der K. Akademie van Wetenschappen. Elfde Deel. 1868. From the Society.

Verslagen en Mededeelingen der K. Akademie van Wetenschappen. Afdeling Natuurkunde. Tweede Reeks. Tweede Deel, Afdeling Letterkunde. Elfde Deel, 1868. From the Society.

Processen-Verbal van de Gewone Vergaderingen der K. Akademie van Wetenschappen. Afdeling Natuurkunde Van Mei 1867 tot en met April. 1868. From the Society.

Jaarboek van de Akademie van Wetenschappen gevestigd te Amsterdam. 1867. From the Society.

Annales Musei Botanici Lugduno-Batavi, edidit F. A. G. Miquel. Tome III, Fasciculi VI—X. 1867. From the Editor.

**Amsterdam.** Archives Néerlandaises des Sciences Exactes et Naturelles, publiées par la Société Hollandaise des Sciences à Harlem. Tome III, 1me—5me Livrs. 1868. From the Society.

**Leiden.** Annalen der Sternwarte in Leiden, Herausgegeben von Dr. F. Kaiser. Erster Band, 1868. From the Observatory.

Archives du Musée Teyler. Vol. I, Fasc. 4me. Vol. II, Fasc. 1 and 2me. 1869. From the Museum.

Natuurkundige Verhandelingen van de Hollandische Maatschappij der Wetenschappen te Haarlem. Tweede Verzameling, 25e Deel. 1868. From the Society.

**Rotterdam.** Nieuwe Verhandelingen van het Bataafsch Genootschap der Proefonder-rindelijke Wijsbegeerte te Rotterdam. Tweede Reeks, Eerste Deel, 1, 2 and 3 Stuk. 1867. From the Society.

**Utrecht.** Nederlandsch Meteorologisch Jaarboek voor 1867. Parts I and II, 1868, 1ste Deel. Uitgegeven door het K. Nederlandsch Meteorologisch Instituut, 1867. From the Institute.

## GERMANY.

**Liegnburg.** Mittheilungen aus dem Osterlande. 18er Band, 3es und 4es Heft. 1868. From the Society.

**Augsburg.** Zwanzigster Bericht des Naturhistorischen Vereins in Augsburg, 1869. From the Society.

**Bamberg.** Sechste, 7e und 8e Berichte der Naturforschenden Gesellschaft zu Bamberg. 1863—1868. From the Society.

**Berlin.** Archiv für Naturgeschichte. Herausgegeben von Dr. F. H. Troschel. 33er Jahrg., 6es Heft, to 35er Jahrg., 1es Heft. From the Editor.

Monatsbericht der K. P. Akademie der Wissenschaften zu Berlin. Aug., 1868, to Oct., 1869. From the Society.

Physikalische und Mathematische Abhandlungen der K. Akademie der Wissenschaften zu Berlin, 1869. From the Society.

Zeitschrift der Deutschen geologischen Gesellschaft. XX Band, 3 Heft, to XXI Band, 3 Heft. From the Society.

Zeitschrift für die Gesamten Naturwissenschaften. Herausgegeben von dem Naturw. Vereine für Sachsen und Thüringen in Halle. Jahrg. 1868.

32er Band. 1868. From the Society.

Wochenschrift des Vereines zur Beförderung des Gartenbaues in den K.

- Preussischen Staaten für Gärtnerei und Pflanzenkunde. Nos. 29 et seq. 1868. From the Society.
- Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin im Jahre 1868, 1869. From the Society.
- Mathematische und Physikalische Abhandlungen der K. Akademie der Wissenschaften zu Berlin, 1867, 1868. From the Society.
- Bonn. Verhandlungen des Naturhistorischen Vereines der Preussischen Rheinlande und Westphalens. 25er Jahrg. 1868. From the Society.
- Bremen. Abhandlungen herausgegeben vom Naturwissenschaftlichen Vereine zu Bremen. 2 Band, 1 Heft. Bremen, 1869. From the Society.
- Brünn. Verhandlungen des Naturforschenden Vereines in Brünn. VI Band, 1867. From the Society.
- Cassel. Journal für Ornithologie. Herausgegeben von Dr. Jean Cabanis. XVI Jahrg., Heft 4, to XVII Jahrg., Heft 5. Purchased.
- Malakozologische Blätter. 15 Band, 6—11 Bog. Pp. 177 to 226. Purchased.
- Chemnitz. Erster und Zweiter Bericht der Naturwissenschaftlichen Gesellschaft zu Chemnitz. 1864—1868, 8vo Tract, 1868. From the Society.
- Danzig. Schriften der Naturforschenden Gesellschaft in Danzig. Neue Folge. 2en Bandes, 2es Heft, 1869. From the Society.
- Novorum Actorum Academiae Cæsareæ Leopoldino-Carolinæ Germanicæ Naturæ Curiosorum. 34 Vol., 1868. From the Society.
- Darmstadt. Notizblatt des Vereins für Erdkunde und verwandte Wissenschaften zu Darmstadt und des Mittelrheinischen geologischen Verein. III Folge, 6 and 7 Heft. From the Society.
- Dresden. Sitzungs-Berichte der Naturwissenschaftlichen Gesellschaft Isis in Dresden. Jahrg. 1868, No. 10, to 1869, No. 6. From the Society.
- Emden. Dreiundfunzigster Jahresbericht der Naturforschenden Gesellschaft in Emden. 1867. From the Society.
- Frankfurt-am-Main. Der Zoologische Garten. IX Jahrg., No. 7, to X Jahrg., No. 6. From the Editor.
- Freiburg. Berichte über die Verhandlungen der Naturforschenden Gesellschaft zu Freiburg, J. B. Band V, Heft 1, 1868. From the Society.
- Giessen. Dreizehnter Bericht der Oberhessischen Gesellschaft für Natur und Heilkunde, 1869. From the Society.
- Gotha. Mittheilungen aus Justus Perthes Geographischer Anstalt. Von Dr. A. Petermann. 1868. XI und XII Ergänzungsheft, Nos. 24 and 25. Purchased.
- Göttingen. Nachrichten von der K. Gesellschaft der Wissenschaften und der

- Zur Geschichte der Museen der K. Akademie der Wissenschaften. I das botanische Museum. From the Society.
- Almanach der K. B. Akad. der Wissenschaften, 1867. From the Society.
- Beobachtungen des Meteorologischen Observatoriums, von 1851—1864 1869. From the Observatory.
- Abhandlungen der Historischen Classe der K. B. Akademie der Wissenschaften. 10ten Bandes, 3e Abth. Philosophisch-Philologischen Classe. 11ten Bandes, 2e Abth. 1867. From the Society.
- Leipzig. Abhandlungen der Naturhistorischen Gesellschaft zu Nürnberg. IV Band, 1868. From the Society.
- Offenbach-am-Main. Neunter Bericht des Offenbacher Vereins für Naturkunde über seine Thätigkeit Offenbach-am-Main, 1868. From the Society.
- Pest. A Magyar Tudományos Akadémia Értekezései. Elso-Evfolyam. 1—17. Szam. Masodik Evfolyam, 1—8 Szam. 1867, 1868. From the Society.
- M. Tudom. Akademia Almanach. 1867, 1868. From the Society.
- Magyar Akadémiai Értekezések. A Matematikai és Természettudományi Osztályok Közlönye. Hatodik Kötet. Elso & Masodik. Füget, 1866. From the Society.
- Mathematikai és Természettudományi Közlemények vonatkozólag a hazai viszonyokra Kiadva a Magyar Tudom. Akad. IV. Kötet. 1865, 1866. From the Society.
- A M. Tudom. Akad. Evkönyve Tizenegyedik Kötet. IV and VI Darab. 1866, 1867. From the Society.
- Értekezések a természettudományi Osztály Köréből. I—XII Szam. Matematikai Osztály Köréből. I and II Szam. 1867, 1868. From the Society.
- Légtuneti Eeszközök. 1 Kötet, 1866. From the Hungarian Academy.
- Prag. Sitzungsberichte der K. B. Gesellschaft der Wissenschaften in Prag. Jahrg. 1868. Jan.—Dec. 1868, 1869. From the Society.
- Abhandlungen der K. B. Gesellschaft der Wissenschaften vom Jahre 1868. 6-te Folge, 2er Band. 1869. From the Society.
- Regensburg. Flora oder allgemeine botanische Zeitung, herausgegeben von der K. B. botanischen Gesellschaft in Regensburg. Neue Reihe. XXVI Jahrg. 1868. From the Society.
- Correspondenz-Blatt des Zoologisch-mineralogischen Vereines in Regensburg. 22er Jahrg., 1868. From the Society.
- Stettin. Entomologische Zeitung. Herausgegeben von dem entomologischen Vereine zu Stettin. 29er und 30er Jahrgang. 1868. From the Society.
- Stuttgart. Neues Jahrbuch für Mineralogie, Geologie und Paläontologie. 1868, Ges. to 1869, 5es Heft. From the Editor.
- Württembergische Naturwissenschaftliche Jahreshefte. 25er Jahrg., 1es Heft. 1869. From the Editors.
- Wien. Jahrbuch der K. K. Geologischen Reichsanstalt. Jahrg. 1868. XVIII Band, No. 3, to XIX Band, No. 2. From the Society.
- Jahrbuch der K. K. Geologischen Reichsanstalt. Jahrg. 1868. XVIII Band, No. 4, to XIX Band, No. 4. From the Society.
- Verhandlungen der K. K. Geologischen Reichsanstalt. No. 6, 1869. From the Society.
- Verhandlungen der K. K. Zoologisch-botanischen Gesellschaft in Wien. XVIII Band, 1—4 Heft, 1868. From the Society.
- Denkschriften der K. Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe. 26er Band, 1868. From the Society.
- Sitzungsbericht der K. Akademie der Wissenschaften, Mathematisch-Naturwissenschaftliche Classe. 57 Band. Erste Abtheil, 1—5 Heft. Zweite Abtheil, 1—6 Heft. 58 Band. Zweite Abtheil, 1 Heft. 1868. From the Society.
- Würzburg. Verhandlungen der Physical-Medecin Gesellschaft in Würzburg. Neue Folge, 1 Band, 2 und 3 Heft, 1868. From the Society.

## SWITZERLAND.

- Basel. Verhandlungen der Naturforschenden Gesellschaft in Basel. 5er Theil, 2es Heft, 1869. From the Society.
- Bern. Mittheilungen der Naturforschenden Gesellschaft in Bern aus dem Jahre 1868. Nos. 654—683. 1869. From the Society.
- Einsieden. Verhandlungen der Schweizerischen Naturforschenden Gesellschaft in Einsieden. 52 Jahresversammlung, 1868. From the Society.
- Geneva. Bibliotheque Universelle et Revue Suisse. Nos. 131 to 142, wanting No. 136. 1868. From the Editor.
- Mémoires de la Société de Physique et d'Histoire Naturelle de Geneva. Tome XIX, 2e Partie, and Tome XX, 1me Partie. From the Society.
- Lausanne. Bulletin de la Société Vaudoise des Sciences Naturelles. Vol. IX, No. 54, to Vol. X, No. 61. From the Society.
- Neuchâtel. Bulletin de la Société des Sciences Naturelles des Neuchâtel. Tome VIII, 1er Cahier. 1868. From the Society.
- Zürich. Vierteljahrsschrift der Naturforschenden Gesellschaft in Zürich. 12er Jahrg., 1es and 2es Heft. 1867. From the Society.

## BELGIUM.

- Bruxelles. Annuaire de l'Académie Royale des Sciences, des Lettres et des Beaux-Arts de Belgique, 1869. 35me Année. From the Society.
- Bulletin of the same. 37me Année. Vols. XXV and XXVI. 1868. From the Society.
- Mémoires of the same. Tome XXXVII. 1869. From the Society.
- Annales Meteorologique de l'Observatoire Royal de Bruxelles. 2me Année. 1868. From A. Quetelet.
- Liège. Mémoires de la Société Royale des Sciences de Liège. 2me Serie. Tome II. 1867. From the Society.
- Louvain. Annuaire de l'Université Catholique de Louvain 1869. 33me Année. From the University.

## FRANCE.

- Angers. Mémoires de la Société Impériale d'Agriculture, Sciences et Arts d'Angers. Nouvelle Période. Tome 11me, Nos. 1 et 2. Tome 12me, Nos. 1 et 2. From the Society.
- Bordeaux. Mémoires de la Société des Sciences Physiques et Naturelles de Bordeaux. Tome VI, 1er et 2e Cahier. 1868. From the Society.
- Société des Sciences Physiques et Naturelles de Bordeaux. Extrait des Procès-Verbaux des Séances. 1869. From the Society.

- Bulletin Mensuel de la Société Imperiale Zoologique d'Acclimatation.**  
2<sup>me</sup> Serie. Tome V, No. 12, to Tome VI, No. 11. From the Society.
- Revue et Magazin de Zoologie, pure et appliquée. Recueil Mensuel, par**  
**M. F. E. Guerin Meneville.** 1868, No. 11, to 1869, No. 8. From the  
Editor.
- Nouvelles Météorologique, publiées sous les auspices de la Société Météo-**  
**rologique de France,** 1868, 1869. Nos. 1—9. From the Society.
- Journal de Conchyliologie.** 3<sup>e</sup> Série. Tome VIII, No 4, to Tome IX,  
No. 3. From the Editor.
- Bulletin des Séances de la Société Impériale et Centrale d'Agriculture de**  
**France.** 3<sup>e</sup> Série. Tome 3<sup>me</sup>, 1858. From the Society.
- Mémoires d'Agriculture, d'Economie rurale et domestique, publiées par la**  
**Société Imperiale et Centrale d'Agriculture de France.** Années 1863—  
1866. 1869. From the Society.
- Annales de la Société Entomologique de France.** 4<sup>me</sup> Serie. Tome 8<sup>me</sup>,  
1868. From the Society.
- Journal de l'Anatomie et de la Physiologie.** Publie par M. Chas Robin.  
5<sup>me</sup> Année. No. 6, 1868. Purchased.
- Toulouse. Mémoires de l'Académie Impériale des Sciences Inscriptions et**  
**Belles-Lettres de Toulouse.** 6<sup>me</sup> Serie. Tome VI, 1868. From the  
Society.

## ITALY.

- Napoli. Atti del Reale Istituto d'Incoraggiamento alle Scienze Naturali,**  
**Economiche e Technologiche di Napoli.** 2<sup>me</sup> Serie, Tomo II et IV. 1867.  
From the Society.
- Palermo. Giornale di Scienze Naturali ed Economiche pubblicato per cura**  
**del Consiglio di Perfezionamento annesso al R. Istituto Technico di**  
**Palermo** 1868. Vol. IV. From the Institute.
- Torino. Memorie della Reale Accademia della Scienze di Torino.** Serie Se-  
conda. Tome 24, 1868. From the Society.
- Atti della R. Accademia della Scienze di Torino.** Vol. III, Disp. 1—7.  
1867. From the Society.
- Catalogo della Leoncidi o Stelle Meteoriche.** Dal Prof. Allessandro Dorna.  
From the Turin Academy.

## PORTUGAL.

- Lisboa. Jornal de Sciencias, Mathematicas, Physicas e Naturæ,** publicado sob  
os auspices da Academia Real das Sciencias de Lisboa. Nos. 4, 5, 6.  
1868, 1869. From the Society.

## GREAT BRITAIN AND IRELAND.

- Dublin. The Journal of the Royal Dublin Society.** No. 37. 1868. From the  
Society.
- Durham. Natural History Transactions of Northumberland and Durham.**  
Part I, Vol. 3. 1869. From the Society.
- Edinburgh. Transactions of the Edinburgh Geological Society.** Vol. I, Pts.  
1 and 2. 1868. From the Society.
- Proceedings of the Royal Physical Society.** Session 1865 and 1866. From  
the Society.
- Transactions of the Royal Society of Edinburgh.** Vol. 25, Part 1. From  
the Society.
- Proceedings of the same.** Vol. VI, No. 74. From the Society.
- Leeds. Report of the Proceedings of the Geological and Polytechnic Society**  
**of the West Riding of Yorkshire,** 1868, 1869. From the Society.
- Liverpool. Proceedings of the Literary and Philosophical Society of Liver-**  
**pool.** Nos. 20—22. 1866—1868. From the Society.
- London. Journal of the Statistical Society of London.** Vol 32. Part III.  
Sept., 1869. From the Society,

- The Student and Intellectual Observer.** Nos. 9 to 21. From the Editor.
- Proceedings of the Scientific Meetings of the Zoological Society of London** for the year 1868, Parts II and III; 1869, Part I. From the Society.
- Transactions of the Zoological Society of London.** Vol. VI, Part 8. From the Society.
- The Athenæum Journal.** Nos. 2132 to 2158, and 2162 to 2186. From the Wilson Fund.
- Nature. A Weekly Illustrated Journal of Science.** Nos. 1—6, 1869. From the Editor.
- The Ibis. New Series.** Nos. 16 to 19. From the Wilson Fund.
- The Journal of Travel and Natural History.** Edited by Andrew Murray. Nos. 1—6, Vol. I. 1868, 1869. Purchased.
- The Annals and Magazine of Natural History.** From Vol. II, No. 12, to Vol. III, No. 17. 1868, 1869. Purchased.
- Trübner's American and Oriental Literary Record.** Nos. 41 to 48. From the Publishers.
- Notes and Queries.** Parts XI to XV. Nov., 1868, to March, 1869. From the Editor.
- The Journal of the Royal Asiatic Society of Great Britain and Ireland.** New Series. Vol. III, Part 2, and Vol. IV, Part 1. From the Society.
- The Quarterly Journal of the Geological Society.** Vol. XXIV, Part 4, to Vol. XXV, Part 4. From the Society.
- Philosophical Transactions of the Royal Society of London.** Vol. 158, Parts 1 and 2. 1868, 1869. From the Society.
- Proceedings of the Royal Society.** Vol. XVI, Nos. 101 to 104. Vol. XVII, Nos. 105 to 109. From the Society.
- The London, Edinburgh and Dublin Philosophical Magazine and Journal of Science.** Fourth Series. From Vol. 36, No. 245, Dec., 1868, to Vol. 37, No. 250, May, 1869. Purchased.
- Reports of the British Association for the Advancement of Science.** 1866, —1868. Purchased.
- The Journal of the Royal Horticultural Society of London.** New Series. Vol. II, No. 6. 1869. From the Society.
- Royal Horticultural Society's Proceedings.** Vol. I, New Series, No. 12. 1868. From the Society.
- Proceedings of the Royal Geographical Society.** Vol. XIII, No. 2. 1869. From the Society.
- The Journal of the Chemical Society.** New Series. Vol. VI, October, to Vol. VII, June. From the Society.

- Occasional Papers of the Boston Society of Natural History. I. Boston, 1869. Entomological Correspondence of Thaddeus Wm. Harris, M.D. Edited by S. H. Scudder. From the Society.
- Second Annual Report of the Peabody Museum of American Archæology and Ethnology. 1869. From the Museum.
- Sixteenth Annual Report of the Trustees of the Public Library. 1868. From the Trustees.
- Bulletin of the Public Library of the City of Boston. No. 8. From the Trustees.
- Cambridge. Bulletin of the Museum of Comparative Zoology. Nos. 6—8. From the Director of the Museum.
- Annual Report of the Trustees of the Museum of Comparative Zoology for 1867. 1868. From the Trustees.
- Proceedings of the American Academy of Arts and Sciences. Vol. XII, p. 345 et seq. From the Society.
- Chicago. The Pharmacist. Vol. I, No. 4, and Vol. II, Nos. 1—3. From the Editor.
- New York. The Medical Record. Vol. IV, Nos. 2 to 18. From the Editor.
- New York Medical Journal. Vol. VIII, No. 4, to Vol. X, No. 3. From the Editor.
- The Chemical News. Vol. IV, No. 1, to Vol. V, No. 5. From Messrs. Townsend & Adams.
- Annals of the Lyceum of Natural History of New York. Vol. IX, Nos. 1—5. From the Society.
- The Medical News and Library. Vol. XXVII, Nos. 313 and 323. From the Editor.
- Eighty-first Annual Report of the Regents of the University of the State of New York. From L. H. Morgan.
- New Haven. The American Journal of Science and Arts. Conducted by Profs. Silliman and Dana. Second Series. Nos. 139 to 144. From the Editors.
- Philadelphia. The Gardener's Monthly. Vol. XI, Nos. 1 to 12. From the Editor.
- American Journal of Pharmacy. Third Series. Vol. XVII, Nos. 1 to 6. From the Editor.
- The American Journal of the Medical Sciences. Edited by Isaac Hays, M.D. Nos. 113 to 116. New Series. 1869. From the Editor.
- The Dental Cosmos. New Series. Vol. XI, Nos. 1 to 12. From the Editor.
- Proceedings of the American Philosophical Society. Vol. X, Nos. 80 and 81. 1868. From the Society.
- Transactions of the American Philosophical Society. Vol. XIII, Part 3. From the Society.
- Proceedings of the American Pharmaceutical Association at the 16th Annual Meeting, 1869. From the Association.
- The Practical Entomologist. Vols. I and II. From the Entomological Society.
- The Medical News and Library. Vol. XXVII, Nos. 313, 322 and 331. From the Editor.
- American Journal of Conchology. Vol. IV, Part 2, to Vol. V, Part 1. 1869—70. From the Publication Committee.
- Transactions of the American Entomological Society. Vol. II, No. 2. From the Society.
- Portland. Proceedings of the Portland Society of Natural History. Vol. I, Part 2. 1869. From the Society.
- Salem. The American Naturalist. Vol. II, No. 11, to Vol. III, No. 10. From the Library Fund.
- Bulletin of the Essex Institute. Vol. I, Nos. 1, 3 and 4. 1869. From the Society.

- Proceedings of the Essex Institute. Vol. V, No. 8. 1868. From the Institute.
- Memoirs of the Peabody Academy of Sciences. Vol. I, No. 1. 1869. From the Society.
- First Annual Report of the Trustees of the Peabody Academy of Sciences. Jan., 1869. From the Society.
- St. Louis. The American Entomologist. Vol. I, No. 1, to Vol. II, No. 3. Purchased.
- Annual Report of the Board of St. Louis Public Schools. 1867—68. From the Board.
- Washington. Monthly Report of the Bureau of Statistics. Treasury Department. Jan., 1869, to No. 29. From the Department.
- Worcester. Proceedings of the American Antiquarian Society at the Annual Meetings held at the Hall of the Society of Worcester Oct. 21, 1868, and April, 1869. From the Society.

## CANADA.

- Halifax, Nova Scotia. Proceedings and Transactions of the Nova Scotian Institution of Natural Sciences. Vol. II, Part 3. From the Society.
- Montreal. The Canadian Naturalist and Geologist. New Series. Vol. III, Nos. 5 and 6, and Vol. IV, No. 2. From the Editors.
- Quebec. Transactions of the Literary and Historical Society of Quebec. Session 1867—1869. Part 6, 1869. From the Society.
- Toronto. The Canadian Entomologist. Vol. I, No. 4, to Vol. II, No. 3. From the Editor.
- Constitution and By-Laws of the Entomological Society of Canada. Toronto. From the Society.
- The Canadian Journal of Science, Literature and History. Vol. XII, Nos. 1 to 4. From the Editors.

## OTHER SCIENTIFIC WORKS.

- Allen, Harrison, M.D. Modern Methods of Investigation. From the Author.
- Allen, J. A. Catalogue of the Reptiles and Batrachians found in the vicinity of Springfield, Mass., with notices of all other species known to inhabit the State. From the Author.
- Notes on Birds observed in western Iowa in the months of July, August

- Bradt, J. F.** *Symbolæ Sirenologicæ. Fasc. II et III Sireniorum ordinus Osteologie Comparata nec non Sireniorum generum Monographiæ.* Petropoli, 1861—1868. From the Author.
- Brigham, Wm. F.** *Notes on Hesperomannia.* Boston, 1869. From the Author.
- Braz, H. G.** *Klassen und Ordnungen des Thierreichs, fortgesetzt von A. Gerstæcker. Fünfter Band. 7 Lief to 6er Band IV Abth, 2 Lief.* From the Wilson Fund.
- Brown, Robert.** *The Miscellaneous Botanical Works of. Vol. III. Atlas of Plates.* Published for the Ray Society, London, 1868. From the Wilson Fund.
- Caligny M. De.** *Liste des Memoires et notes présentés a l'Academie des Sciences ou publiés dans divers recueils.* From the Author.
- Carus, Jul. Victor.** *Handbuch der Zoologie. Von Jul. Victor Carus und O. E. A. Gerstæcker. 1er Band, 1 H-ft.* Leipzig, 1868. Purchased.
- Catalogue and Synonymy of the Genera, Species and Varieties of Recent Mollusca described prior to Jan. 1st, 1867. Part 2.** Philadelphia, 1869. From the Conchological Section.
- Catalogue of Books added to the Library of Congress from Dec. 1, 1867, to Dec. 1, 1868.** Washington, 1869. From the Librarian.
- Catalogue of Kentucky University.** 1869. Lexington. From the University.
- Catalogue of Scientific Papers.** Compiled and published by the Royal Society of London. Vol II. London, 1868. From the Society.
- Catalogues van de Boekerij der K. Akad. der Wetenschappen, gevestigd te Amsterdam. Tweeden Deels Tweede Stick.** Amsterdam, 1868. From the Society.
- Chemical Analysis of Louisiana Rock Salt.** New Orleans, 1869. From Dr. Jos. Jones.
- Circular No. 2. Surgeon-General's Office. Report on the Excisions of the Head of the Femur for Gunshot Injury.** From the Surgeon-Genl's.
- Cotthold, T. Spencer.** *Entoza, being a Supplement of the Introduction to the Study of Helminthology.* London, 1869. From the Author.
- Cook, Geo. H.** *Geology of New Jersey.* Newark, 1868. One Volume Text and one Volume Atlas. From the Author.
- Cope, Edw. D.** *Seventh Contribution to the Herpetology of Tropical America.* From the Author.
- Synopsis of the Extinct Batrachia, Reptilia and Aves of North America. Part I.** From the Author.
- Cornelissen, J. E.** *Royal Meteorological Institute of the Netherlands. On the Temperature of the Sea at the surface near the south point of Africa.* Utrecht. From the Institute.
- Credner, Dr. H.** *Die Gliederung der eozöischen Formationsgruppe Nord Amerikas.* Halle, 1869. From the Author.
- Dana, James Dwight.** *A System of Mineralogy. By James Dwight Dana, aided by George Jarvis Brush. Fifth Edition.* New York, 1869. From Joseph Jeanes.
- Dawson, J. W.** *Modern Ideas of Derivation.* From the Author.
- Acadian Geology. The Geological Structure, organic remains and mineral resources of Nova Scotia, New Brunswick and Prince Edward Island.** London, 1868. From Joseph Jeanes.
- De Saussure, M. Henri.** *Etudes sur l'Aile des Orthopteres.* From the Author.
- Details of an unpaid claim on France for 24,000,000 Francs, guaranteed by the Parole of Napoleon III.** Philadelphia, 1869. From R. A. Parrish, Jr.
- Dillwyn, L. W.** *Materials for a Fauna and Flora of Swansea and its Neighborhood.* 8vo. Swansea, 1848. From the Authors.
- Dippel, Dr. L.** *Das Mikroskop und seine Anwendung. 2er Theil. 1ste Abth.* Brannschweig, 1869. Purchased.
- Dole, Sanford B.** *A Synopsis of the Birds of the Hawaiian Islands.* Boston, 1869. From the Author.

- D'Ourches, M. le Marquis. *Inhumations Precipitées*. St. Germain-en-Laye, 1869. From M. de Caligny.
- Doxy, F. *Bryologia Javanica*, Antoribus F. Doxy, et J. H. Molkenbauer. Fasc. 58—60. Lugduni Batavorum, 1868. Purchased.
- Dubois, Ch. F. *Oiseaux de l'Europe*. 236—239 Livr. From the Wilson Fund.
- Dunker, Dr. W. *Palæontographica*. Beiträge zur Naturgeschichte der Vorwelt. 16er Band, 7er Lief. 17er Band, 2e and 3e Lief. 18er Band, 4—8 Lief. From the Wilson Fund.
- Ehlers, Ernest. *Die Borstenwürmer Annelida Chaetopoda*. 1ste and 2e Abth. Leipzig, 1868. Purchased.
- Eight Theses. Louvain, 1862. From the University of Louvain.
- Elettroscopio del Cav. Macedonio Melloni. Napoli, 1854. From the Author.
- Elliot, D. G. *The Birds of North America*. Parts I to XV. New York, 1866—68. Obtained in Exchange.
- Finsch, Dr. Otto. *Die Papsageneien*. 2er Band. Leiden, 1868. From the Karsten, H. *Flora Columbica terrarumque adiacentium specimina selecta* Tomi II, Fasc. 5. Berolini. 1869. From the Wilson Fund.
- Gabb, Wm. M. *Palæontology of California*. Vol. II. Cretaceous and Tertiary Fossils. 1869. From the Library Fund.
- Geological Survey of Illinois. Vol. I. Geology, Vol. II. Palæontology. Chicago, 1866. From A. H. Worthen.
- Gervais, Paul. *Zoologie et Paléontologie générales*. Première Serie. Livr. 8—11. Paris, 1869. From the Wilson Fund.
- Gore, G. *On Hydrofluoric Acid*. From the Author.
- Gould, Benj. Aphrop. *Sanitary Memoirs of the War of the Rebellion*, collected and published by the United States Sanitary Commission. Investigations in the Military and Anthropological Statistics of American Soldiers. New York, 1869. From the Commission.
- Gould, J. *The Birds of Great Britain*. Parts XIII and XIV. London, 1868. From the Wilson Fund.
- The Birds of Asia*. Part XX. London, 1868. From the Wilson Fund.
- Graesse, J. G. T. *Trésor de Livres rares et précieux*. Supplement. Tome VII, Livr. 41. Dresde, 1869. From the Wilson Fund.
- Günther, Albert C. L. G. *The Record of Zoological Literature*. 1867. Vol. 4th. London, 1868. Purchased.
- Hayden, F. V., M. D. *Geological Reports of the Exploration of the Yellowstone and Missouri Rivers*. 1859—60. Washington, 1869. From Genl Humphreys.
- Hewitson, Wm. C. *Exotic Butterflies*. Parts 68—72. From the Wilson Fund.
- Humboldt, A. M. *Über die Zerstörung und Erneuerung der Adreiationen*

- Lea, Isaac, L. L. D.** Observations on the Genus Unio. Vol. XII. Philadelphia, 1869. From the Author.  
 Index to Vol. XII and Supplementary Index to Vol. I to XI of same. Vol. II. Philadelphia, 1869. From the Author.
- Le Maout, M.** Traité général de Botanique descriptive et Analytique, par M. M. Le Maout et Decaisne. Paris, 1868. Purchased.
- Le Spectacle de la Nature.** 5 Vols, 12mo. Paris, 1765—66 Second Volume wanting. From Isaac Lea.
- Lischke, Dr. C. E.** Novitates Conchologicæ. Supplement IV. Japanische Meeres—Conchylien. 1—4 Lief. Cassel. From the Wilson Fund.
- Ltken, C. F.** Additamenta ad historiam Ophiuridarum. Af Chr. Fr. Lütken. Kiøbenhavn, 1869. From the Author.
- Manuscripts relating to the Early History of Canada.** Quebec, 1866. From the Historical Soc. of Quebec.
- Masters, Maxwell F., M. D.** Vegetable Teratology. An account of the principal deviations from the usual construction of Plants. London, 1869. From the Wilson Fund.
- Maury, M. F.** Physical survey of Virginia. Richmond, 1868. From the Author.
- Mayer, Alfred M.** Lecture—Notes on Physics. Philadelphia, 1868. From the Author.
- Mayer, Charles.** Catalogue Systematique et descriptif des Fossiles des Terrains Tertiaires qui retrouvant au Musée federal de Zurich. 2me et 3me Cahier. Zurich, 1867—68. Purchased.
- Meyer, Adolf Bernhard.** Ueber den Giftapparat der Schlangen insbesondere über den der Gattung Callophis (Gray). From the Author.
- Moore, J. Scott.** Pre-Glacial Man and Geological Chronology. Dublin, 1868.
- Mortillet, Gabriel de.** Matériaux pour l'histoire primitive et philosophique de l'homme. 4me Année, No. 5, to 5me Année, No. 10. From the Library Fund.
- Naphegyi, G., M. D.** Among the Arabs. A narrative of Adventures in Algeria. Philadelphia, 1868. From the Author.  
 The Alphabets of the World. An extract from Náphegyi's Album of Languages. From the Author.
- Neilreich, Dr. A.** Die Vegetationsverhältnisse von Croatien. Wien, 1868. From the Author.
- Newberry, J. S.** Notes on the later extinct floras of North America. From the Author.
- Niessel, G. V.** Ueber Asplenium adulterinum, Milde. Brünn, 1868. From the Author.
- Nordenskiöld, A. E.** Sketch of the Geology of Spitzbergen. Stockholm, 1867. From the Author.
- Norges Officielle Statistik.** Udviden i aaret 1867—1868. 13 Pamphlets. From the Norwegian Government.
- On the existence of rocks containing organic substances in the fundamental gneiss of Sweden.** From the Royal Swedish Academy.
- Owen, Richard.** On the Anatomy of Vertebrates. Vols. 1, 2 and 3. London, 1866—1868. From Joseph Jeanes.
- Paladilhe, Mr.** Nouvelles Miscellanées Malacologiques. 2me and 3me fasc. Paris, 1868. From the Author.
- Palæontographica,** Beiträge zur naturgeschichte der Vorwelt. 16er Band, 6ste Lief, 18er Band, 2e and 3e Lief. Cassel, 1868. From the Wilson Fund.
- Palæontological Memoires and Notes of the late Hugh Falconer, A. M.** 2 Vols., 8vo. London, 1869. From the Library Fund.
- Palæontologie Francaise.** Terrain Jurassique. Livrs. 15—18. Paris. From the Wilson Fund.
- Palmer, Gen. Wm. J.** Reports of Surveys across the Continent in 1867—68. Philadelphia, 1869. From the Author.

- Payot, V. *Catalogue de la Série des Roches de la Chaîne du Mont Blanc*, 4to. Geneva, 1864. From John Warner.
- Catalogue Phytostatique de Plantes Cryptogames Cellulaires du Mont Blanc*. From John Warner.
- Enumeration des Mousses Nouvelles, rares et peu connues des Environs du Mont Blanc*. From John Warner.
- Erpétologie, Malacologie et Paléontologie des Environs du Mont Blanc*. Lyon, 1864. From John Warner.
- Perry, Rev. John B. *Queries on the Red Sand Stone of Vermont, and its relations to other Rocks*. Boston, 1868. From the Author.
- Pfeiffer, Dr. L. *Novitates Conchologicæ*. I Abth, 33—35 Lief. III, 12—15. Venus, pp. 137—145, Lfg. 16—19, IV, 1—4 Lief. Cassel. From the Wilson Fund.
- Pfeiffer, Ludovico. *Monographia Heliceorum viventium*. Vols. V and VI. Lipsiæ, 1868. From the Wilson Fund.
- Porter, Thos. C. *An enumeration of indigenous and naturalized Plants found growing in the County of Lancaster, Pa.* From the Author.
- Pouchet, F. A., M. D. *The Universe, or the Infinitely Great and the Infinitely Little*. New York, 1870. Presented by Jos. Jeanes.
- Pritzel, G. A. *Iconum Botanicarum Index*. Pars Altera, 2er Theil. Purchased.
- Pursh, Fred. *Journal of a Botanical Excursion in the North-eastern parts of the States of Pennsylvania and New York, during the year 1807*. Philadelphia, 1809. From Thos. P. James.
- Quetelet, M. Ad. *Sur l'Homme et le développement de ses Faculties*. From the Author.
- Sur les Phénomènes Périodiques en Général*. From the Author.
- Quaterfages, M. de. *Observations relatives à un ouvrage de M. Claparède intitulé, 'Les Annélides Chetopodes du Golfe de Naples, et Réponse à ses critiques.'* From the Author.
- Rapport sur une communication de M. Vallés, faites à l'écluse de l'Aubois, pour déterminer l'effet utile de l'appareil à l'aide duquel M. de Caligny diminue dans une proportion considérable la consommation d'eau dans les canaux de Navigation*. From M. de Caligny.
- Rapport Verbal sur un ouvrage imprimé de M. Gialdi intitulé, 'Sul moto ondoso del mare e su le correnti d'esso, specialmente su quella littorali.'* From M. de Caligny.
- Raymond, Rossiter, W. *Mineral resources of the States and Territories west of the Rocky Mountains*. Washington, 1869. From the Author.

- Om de i Norge Forekommende Fossile Dyreløvinger fra Quartaerperioden et Bidrag til vor Faunas Historie.* From Dr. Jos. Leidy.
- Mémoires pour servir à la connaissance des Crinoides Vivantes.* Christiania, 1867. From the Author.
- Sclater, P. L. *Exotic Ornithology.* By Philip Lutley Sclater and Osbert Salvin. Parts VIII—XI. London. From the Wilson Fund.
- Seadler, S. H. *Catalogue of the Orthoptera of North America described previous to 1867.* Washington, 1868. From the Smithsonian Inst.
- Entomological Notes.* II. From the Author.
- Schlegel, H. *Recherches sur la Faune de Madagascar et des ses dépendance.* Par H. Schlegel et Francois P. L. Pollen. Leyden, 1868. From the Wilson Fund.
- Schramm, M. A. *Catalogues des Coquilles et des Crustacés de la Guadeloupe.* 2me. Ed. Basse-Terre, 1869. From the Author.
- Smith, Lloyd P. Address delivered at Haverford College before the Alumni Association, at their Annual Meeting. Oct. 24, 1868. From the Author.
- Sul, C. *Hemiptera Africana descripsit.* Tomi 1—4. Holmiæ, 1864—1866. Purchased.
- Sark, Robert M. *A popular History of British Mosses.* Second Edition. London, 1860. From Thomas Meehan.
- Stadevall, C. J. *Conspectum Avium Picinarum.* Stockholmæ, 1866. Purchased.
- Die Thierarten des Aristoteles von den Klassen der Säugethiere, Vögel, Reptilien und Insekten.* Stockholm, 1863.
- Sanichrast, F. *The Geographical Distribution of the Native Birds of the Department of Vera Cruz, with a list of the Migratory Species.* Translated from the French by F. W. Brewer, M.D. Boston, 1869. From the Translator.
- Surveys of the Conneant and Pymatuning Swamps in Crawford County.* Report of the Surveyor General of Pennsylvania. Harrisburg, 1869. From the Authors.
- S Fregatten Eugenie's resa omkring Jorden.* Zoologi, VI. Stockholm.
- Tschudi, J. J. von. *Reisen durch Süd-America.* Fünfter Band. Leipzig, 1849. Purchased.
- Turnbull, Wm. P. *The Birds of East Pennsylvania and New Jersey.* From the Author.
- Van Beneden, M. M. *Osteographie des Cétacés vivants et fossiles.* Par M. M. Van Beneden and Paul Gervais. Texte, Livr. 1—5. Atlas, Livr. 1—5. Paris. Purchased.
- Vogt, Carl. *Kritische Darlegung der Urgeschichte des Menschen.* From the Author.
- Walpers. *Annales Botanices Systematicæ.* Tomi Septimi, Fasc. I—III. Auctore Dr. C. Mueller. Lipsiæ, 1868. From the Author.
- Wolf, Joseph. *Zoological Sketches.* Second Series, Part XIII. London. From the Wilson Fund.
- Wood, Dr. H. C., Jr. *Prodromus of a study of North American Fresh-water Algæ.* From the Author.
- Woodward, Dr. S. P. *A Manual of the Mollusca; a treatise of Recent and Fossil Shells.* Second Edition. London, 1868. Purchased.
- Worsaae, J. J. A. *Nordiske Oldsager i det Kongelige Museum i Kjøbenhavn.* Ordne og forklarede. Kjøbenhavn, 1854. From John Warner.
- Wright, Wm. *The Oil Regions of Pennsylvania.* New York, 1865. From the Library Fund.

## INDEX TO GENERA.

Accipiter.....	184	Camptolemus.....	219
Actinocrinites.....	153	Cancroma.....	200, 219
Adelarus.....	214	Canis.....	181
Æchmophorus.....	212	Cardiomorpha.....	172
Ægiolhus.....	180	Carya.....	1
Æstrelata.....	213	Casarca.....	215
Agapheius.....	14	Cassia.....	176
Agaricocrinus.....	163, 167	Catharacta.....	212
Agelaius.....	126	Ceratorhyncha.....	211
Aix.....	216	Cereopsis.....	217
Alca.....	200, 205, 211	Chænocardia.....	179
Allorisma.....	171	Chaulclasmus.....	217
Amblyrhiza.....	92	Cheirocrinus.....	72
Amblystoma.....	95	Chenalopex.....	217
Ambrosia.....	189	Cheniscus.....	217
Ampelis.....	182	Chenopsis.....	216
Amphoracrinus.....	163	Chlæphaga.....	217
Anaides.....	93, 94, 109	Chonetus.....	179
Anas.....	217	Choristopus.....	217
Androcryphia.....	228	Chrococephalus.....	216
Anous.....	214	Chrysomitris.....	126, 181
Anser.....	127, 185, 217	Cinclus.....	200
Archæocidaris.....	80	Ciangula.....	217
Archæopteryx.....	197	Codaster.....	94
Aspidium.....	179	Codonites.....	54
Anseranas.....	217	Cœcilia.....	83
Anthoceros.....	230	Cœliocrinus.....	139

<i>Delphinapterus</i> .....	7, 22	<i>Hemipodius</i> .....	199
<i>Delphinus</i> .....	22	<i>Hemisalamandra</i> .....	93
<i>Dendrocygna</i> .....	217	<i>Hierofulco</i> .....	184
<i>Desmognathus</i> .....	94, 112	<i>Histrionicus</i> .....	217
<i>Dichocrinus</i> .....	69	<i>Holops</i> .....	123
<i>Dicholophus</i> .....	198	<i>Hunterius</i> .....	14
<i>Dicotyles</i> .....	3	<i>Hydrochelidon</i> .....	204, 208, 214
<i>Diemyctylus</i> .....	93	<i>Hylocichla</i> .....	127
<i>Diomedea</i> .....	205, 212	<i>Hylonomus</i> .....	93
<i>Dorycrinus</i> .....	163, 166	<i>Hyperaodon</i> .....	31, 191
<i>Duvalia</i> .....	229	<i>Hypsibema</i> .....	192
<i>Echinus</i> .....	81	<i>Iguanodon</i> .....	123
<i>Emys</i> .....	66	<i>Inca</i> .....	214
<i>Eocidaris</i> .....	78, 79	<i>Ixacanthus</i> .....	6
<i>Ereunetes</i> .....	208	<i>Junco</i> .....	126
<i>Erinaceus</i> .....	64	<i>Jungermannia</i> .....	219
<i>Erismatura</i> .....	218	<i>Lagopus</i> .....	184
<i>Erisocrinus</i> .....	70	<i>Larix</i> .....	177
<i>Eschrichtius</i> .....	7, 10, 14, 192	<i>Larus</i> .....	184, 214
<i>Eucheirocrinus</i> .....	73	<i>Lejeunia</i> .....	223
<i>Fimbriaria</i> .....	230	<i>Lepidechinus</i> .....	77, 80
<i>Fratercula</i> .....	205, 211	<i>Lepidesthes</i> .....	77
<i>Fregetta</i> .....	203, 212	<i>Lepidocentrus</i> .....	77
<i>Fringilla</i> .....	185	<i>Lepidodendron</i> .....	79
<i>Frossombronia</i> .....	228	<i>Leptotarsus</i> .....	217
<i>Frullania</i> .....	225	<i>Lepus</i> .....	184
<i>Fuligula</i> .....	21	<i>Lestris</i> .....	213
<i>Fulix</i> .....	217	<i>Leucosticte</i> .....	182
<i>Fulmarus</i> .....	184, 206	<i>Lima</i> .....	172
<i>Galeopithecus</i> .....	64	<i>Linota</i> .....	182
<i>Galerix</i> .....	64	<i>Lomvia</i> .....	211
<i>Gelochelidon</i> .....	214	<i>Longipennes</i> .....	213
<i>Geotriton</i> .....	94, 95, 102	<i>Lophocetus</i> .....	6
<i>Gervillia</i> .....	172	<i>Lophocolea</i> .....	222
<i>Gilbertsocrinus</i> .....	75	<i>Lophodytes</i> .....	218
<i>Globiocephalus</i> .....	21, 58	<i>Loxomylus</i> .....	92
<i>Glyptostrobus</i> ..	178	<i>Lunda</i> .....	211
<i>Goniasteroidocrinus</i> .....	75, 88	<i>Macrorhinus</i> .....	61
<i>Goniobasis</i> .....	125	<i>Macrosaurus</i> .....	123
<i>Granatocrinus</i> .....	84, 88	<i>Majaqueus</i> .....	212
<i>Graphiocrinus</i> .....	137	<i>Manculus</i> .....	95, 101
<i>Gygis</i> .....	213	<i>Mareca</i> .....	217
<i>Gymnanthe</i> .....	223	<i>Melanetta</i> .....	217
<i>Gymnura</i> .....	64	<i>Megalonyx</i> .....	3
<i>Gyrinophilus</i> .....	95, 108, 118	<i>Megaptera</i> .....	10, 14, 19, 49
<i>Hadrosaurus</i> .....	123, 192	<i>Megistocrinus</i> .....	163
<i>Haliplana</i> .....	214	<i>Merganetta</i> .....	218
<i>Halobæna</i> .....	213	<i>Mergellus</i> .....	218
<i>Halocyptena</i> .....	206, 212	<i>Mergulus</i> .....	200, 203, 211
<i>Halodroma</i> .....	200	<i>Mergus</i> .....	218
<i>Harelda</i> .....	206, 213, 217	<i>Mesoplodon</i> .....	192
<i>Harporhynchus</i> .....	188	<i>Mimus</i> .....	188
<i>Heloderma</i> .....	5	<i>Mixophagus</i> .....	3
<i>Hemiacis</i> .....	3	<i>Nanohyus</i> .....	65
<i>Hemidactylum</i> .....	94, 99		

Nettion .....	217	Pontomogale .....	64
Nucleorinus .....	84	Poteriocrinites.....	137
Nyctea.....	182, 184	Preissia .....	239
Nyroca .....	217	Prioninus .....	312
Oceanites.....	203, 206, 212	Prion.....	202, 213
Oceanodroma .....	212	Priscodelphinus.....	5, 10
Oedipus.....	95, 102	Protaster .....	83, 169
Oidemia .....	217	Prothyris.....	172
Olor.....	216	Ptychorhampus.....	211
Omomys.....	63	Puffinus .....	260, 213
Onychaster .....	82	Pygopodes.....	313
Opheobatrachus.....	94, 95, 101	Pyranga.....	120
Orca .....	22, 55	Querquedula.....	217
Ornithorhynchus.....	203	Quiscalus .....	133
Ornithotarsus .....	123		
Ossifraga.....	206	Rana.....	94
Palæchinus .....	81	Rhabdosteus.....	6
Pagodroma .....	213	Rhachianectes.....	14, 40
Pagophila .....	184, 213, 214	Rhodostethia .....	214, 206
Pelagodroma.....	203, 212	Rhynchops.....	214
Pelecanoides .....	213, 215	Riccia.....	231
Pelicanus .....	206, 215	Rissa.....	207, 214
Pelionetta .....	217	Saccoerinus.....	163
Pentremites.....	83	Saccogynis .....	223
Perischodomus.....	77	Sagmatorrhina.....	211
Phæbetria .....	212	Salamandra .....	93
Phæthon.....	206, 213, 316	Sarkidiornis.....	217
Phalacrocorax.....	215	Santeria.....	229
Philocrinus.....	70	Sendtnera.....	224
Phocæna .....	23, 53	Scapania .....	216
Phœnicopterus.....	204	Scaphiocrinus .....	137
Phœtusa .....	214	Schizæa.....	13
Pholidocidaris.....	78	Schizodus.....	172
Phragmicoma .....	225	Schizostoma.....	125
Physa.....	125	Sciurus .....	3
Physeter .....	32, 59	Sibbaldius .....	15, 20, 51
Physetocrinus.....	158	Smurlynchus .....	311

<b>Sylbeocyclas</b> .....	212	<b>Thuja</b> .....	122
<b>Symphemia</b> .....	208	<b>Tinamus</b> .....	199
<b>Synbathocrinus</b> .....	67	<b>Tretosphys</b> .....	6, 7
<b>Synthliborhampus</b> ..	211	<b>Trionyx</b> .....	12, 66
<b>Syrrhaptēs</b> .....	199	<b>Tupaia</b> .....	64
		<b>Turdus</b> .....	127
<b>Tachypetes</b> .....	200, 205	<b>Unio</b> .....	124
<b>Tadorna</b> .....	217	<b>Uria</b> .....	205, 211
<b>Tamias</b> .....	3	<b>Ursus</b> .....	3, 184
<b>Tapirus</b> .....	3	<b>Urtica</b> .....	136
<b>Taxodium</b> .....	178	<b>Utamania</b> .....	211
<b>Thalasseus</b> .....	214		
<b>Thalassidroma</b> .....	206	<b>Xema</b> .....	214
<b>Thalassoica</b> .....	184, 212	<b>Xylophaga</b> .....	172
<b>Thalassornis</b> .....	218		
<b>Thecachampsā</b> .....	11, 192	<b>Zarhachis</b> .....	9
<b>Thiellus</b> .....	212	<b>Zeacrinus</b> .....	138, 149
<b>Thoracosaurus</b> .....	123	<b>Zonotrichia</b> .....	126
<b>Thorius</b> .....	111		

## GENERAL INDEX.

- Austin, C. F., Characters of some new Hepaticæ (mostly North American), together with notes on a few imperfectly described species, 218.
- Baucker, Chas. N., Announcement of death of, 3.
- Cassin, John, Resolutions with reference to the death of, 1.
- Committees, Standing, for 1869, 2.
- Cope, E. D., Remarks on fossils from the Southern States, 3; Third contribution to the Fauna of the Miocene Period of the United States, 4, 6; On the Cetaceans of the Western Coast of North America, 6, 13; Remarks on *Heloderma horridum*, 5; A review of the species of *Plethodontidæ* and *Desmognathidæ*, 91, 93; Remarks on fossils from Anguilla, W. I., 92; Remarks on *Thoracosaurus*, *Ornithotarsus*, and *Macrosaurus*, 128; On the cranium of *Hyperaodon hiden*, and on *Mesoplonodon*, *Echrichius*, *Hadrosaurus*, and *Polydectes*, 192.
- Correspondence, 245.
- Coues, E., On the variations of the Genus *Aegiothus*, 179, 180; On the classification of water birds, 191, 193.
- Davis, J. B., An attempt to ascertain the average weight of the brain in different races of mankind 93
- of Bractes in *Larix*, 123, 176; On the gland-bearing leaves on the peach and cherry, 136; On the fibre of Ramie, 136; Remarks on adventitious and axillary buds, 178; On the law of development in the flowers of *Ambrosia artemisiæfolia*, 180, 189.
- Meek, F. B. and A. H. Worthen, Description of new Crinoidea and Echinoidea from the carboniferous rocks of the Western States, with a note on the Genus *Onychaster*, 12, 67; Remarks on the Blastoides, with descriptions of new species, 12, 83, Description of new carboniferous fossils from the Western States, 123, 137.
- Meigs, Dr. Chas. D., Announcement of death of, 124.
- Officers for 1870, 243.
- Redfield, J. H., Note on *Schizæa pusilla*, 13; Note on *Corema Conradii*, 91; On *Aspidium aculeatum*, 179.
- Report of Curators, 234.
- Report of Ornithological Committee, 237.
- Report of Librarian, 238.
- Report of Recording Secretary, 239.
- Reports of Conchological Section, 240.
- Resolution regarding the Humboldt festival, 172.
- Ridgway, Robert, Notice of certain

# BIOLOGICAL AND MICROSCOPICAL DEPARTMENT

OF THE

## ACADEMY OF NATURAL SCIENCES.

---

*January 4th.*

MR. J. D. SERGEANT in the Chair.

Twenty-one members present.

Dr. McQUELLEN remarked that, in conjunction with Mr. Walmsley, he had made some attempts to mount blood corpuscles in such way as should maintain their natural shape. In solutions of glycerine and water, the form of the corpuscle of the frog had rapidly altered, but Mr. Walmsley had mounted some in glycerine jelly which remained unaltered up to date.

Dr. TROX stated that to expect success with the aqueous preservative fluids was scarcely reasonable, unless a menstruum were used identical in its specific gravity with the liquor sanguinis of the blood. Such a solution can be obtained with glycerine and distilled water, in the proportion about 73ij of Bourn's glycerine to 73iiss of distilled water, and if one part of carbolic acid be added to 100 parts of the mixture, a suitable preservative fluid is obtained for many animal tissues.

---

*January 18th.*

Director S. W. MITCHELL, M. D., in the Chair.

Twenty-four members present.

Dr. WOOD exhibited to the department four species of the genus *Sirosiphon*, all of which he stated to be new to North America, and three entirely undescribed. One of them had been found growing on the face of a wet rock on the banks of the Wissahicon, by Dr. J. Gibbons Hunt, from whom he had received specimens. These are referable to *Sirosiphon pulvinatus* of Europe.

Two of the new species were collected in South Carolina, by Prof. H. W. Lathrop, who sent them to Dr. Billings, U. S. A., to whom Dr. W. stated he was indebted for the specimens. The following are the descriptions:

*S. IGNICOLA*.—*S. strato* expanso, tomentoso, atro; trichomatibus ramulosis, arcte intertextis; ramulis abbreviatis vel elongatis, subrectis aut curvatis, apice obtuso rotundatis vel subacuminatis; trichomatum et ramulorum cellulis internis uni-biseriatis, plerumque pachydermatis, dilute vel saturate ærugineis, enormibus, plerumque homogeneis terminalibus elon-

gatis, cylindricis, sæpius nonnihil oscillarum modo articulatis, granulatis; vaginis sat amplis, haud achrois, vel luteo brunneo, vel fuscis vel ferrugineis.

Diam. Trich. C. V. max  $1\frac{1}{8}$ ''

For the second species the specific name of *guttula* was proposed, from its habit of forming little drop like dots on the bark on which it grows. The following is the specific description.

*S. phloiophilum*, in maculis subnigris, parvis, tenuibus, plerumque rotundatis, interdum enormibus, dispositum; trichomatibus arcte intertextis, ramosissimis, rigidis, inæqualibus, subcylindricis, nonnihil contortis; ramulis abbreviatis vel nonnihil elongatis, apice obtuse rotundatis; ramulorum et trichomatum cellulis tri-multiseriatis, plerumque pachydermaticis, ferrugineo-fuscis, enormiter globosis, homogeneis; cellulis apiculibus interdum brevibus cylindricis, haud articulatis; vaginis sat amplis, luteo-brunneis vel dilute ferrugineo-brunneis.

Diam. Max. trich. cum. vag.  $7\frac{1}{8}$ ''

The other new species had been found growing in some stagnant water, with a number of other algae, in New Jersey. The filaments were widely separated and were so large as to be visible to the naked eye. The following is the specific description:

*SINOMIPHON DISJUNCTUM*.—*S. trichomatis subsolitaria*, longis usque ad lineam quatuor, cylindricis, ramosis; ramulis singulis; cytoplasmate interdum ærugineo, plerumque aureo-brunneo, in ramulorum apice interdum nullis sed plerumque in cylindricis longis oscillarum nonnihil modo articulatis cellulis internis uniseriatis, rare biseriatis, subglobosis, interdum sejunctis plerumque arcte connectis et moniliformibus, modo confluentibus, haud pachydermaticis; cellulis interstitialibus nullis; vaginis achrois, interdum brunneis.

Diam. Trich. cum vag.  $3\frac{1}{8}$ ''; sine vag.  $1\frac{1}{8}$ ''

Mr. W. H. Walmsley exhibited a slide showing an unrecognized larva which he found infesting the potato, and which he believes to be a cause of the potato rot, so common in the potatoes at present in the market.

Dr. McQuillen exhibited specimens of *Trichina spiralis*, from a patient recently dead of rhythm vulgaris, at the Philadelphia

large globular heterocysts raised on short branches. No distinct sheaths were visible; everywhere between the filaments was a uniform jelly.

The following are the generic and specific characters:

Genus *Nostochopsis*. Thallus definitus, trichomata ramosa; cellulis perdurantibus in latere sessilibus aut in ramulis brevissimis superpositis.

*C. LOBATA*.—*C.* thallo viride aut luteo-viride, cavo, enormiter lobato, natante, modice magno, (ad 0.5 unc in diametro); trichomatibus plerumque longis, flexuosis, viride, modo inarticulatis, partim articulatis, cylindricis aut submoniliformibus, sparse granulatis.

---

February 15th.

Director S. W. MITCHELL, M. D., in the Chair.

Twenty-two members present.

---

March 1st.

Director S. W. MITCHELL, M. D., in the Chair.

Twenty-six members present.

Dr. R. J. LEVIs exhibited two pathological specimens illustrating embolism,—one, an embolus, three inches long, from the external iliac artery; the *second*, a gangrenous hand, in which the condition was induced by embolism of the brachial artery.

---

March 15th.

Director S. W. MITCHELL, M. D., in the Chair.

Twenty-two members present.

---

April 5th.

DR. RUSCHENBERGER in the Chair.

Twenty-two members present.

Dr. J. G. HUNT remarked, that in a specimen of *Cissus* in his possession, he had recently noticed in the leaves such an exuberant growth that the parenchyma actually burst through the cuticle. That he had also noted, growing in its vicinity, a specimen of the *Cuscuta*, which soon embraced the *Cissus*, and by its parasitic rootlets planted itself upon the latter plant, in which the exuberant growth was taking place, after which this excess of growth was gradually checked. The *Cuscuta* is a parasite which never attaches to cryptogams; a fact probably indicating some undetected difference in the sap of the flowering and the flowerless plant.

---

April 19th.

Director S. W. MITCHELL, M. D., in the Chair.

Twenty-three members present.

Dr. J. G. HUNT presented the following:

*Improved Microscopical Cement*.—Dissolve old and hard Canada balsam in chloroform until it is quite fluid; then add enough oxide of zinc ground in

linseed oil to bring the mixture to the consistence of cream. If it dries too quickly on the brush to work smoothly, add a small quantity of oil of turpentine. Occasionally stir the mixture before using. This cement dries very quickly and retains a fine polish, does not become brittle, and will not run in under the thin glass cover. If proper care be used, all ordinary danger from leaking when objects are mounted in cells, can be obviated. It may be colored if desirable.

An impression prevailed with some members that this was the form of cement recommended by Dr. H. C. Bastian, in No. II of the new "Monthly Microscopical Journal," of London, a cement much used in Germany. With this cement, however, composed of solution of gum-mastic in chloroform, thickened with nitrate of bismuth, Dr. Hunt was familiar, and having used it, finds it far inferior to that made according to the formula furnished by him this evening.

MR. WALMSLEY had used these cements, and accorded the superiority to that of Dr. Hunt.

---

*May 3d.*

Director S. W. MITCHELL, M. D., in the Chair.

Twenty-six members present.

DR. J. G. RICHARDSON read a paper "On the detection of red and white blood corpuscles in Blood Stains," with experiments to prove that the colorless material left after the action of pure water on dried blood clot is not simply fibrous, as appears to have been hitherto supposed by Robin, Virchow, Fleming and other authorities, but chiefly an aggregation of those external portions of innumerable corpuscles, which probably correspond to and certainly constitute their cell walls.

For paper, see Am Jour. Med. Sciences, July, 1869.

DR. WILLIAM PEPPER presented a specimen of a small pedicellated cystic body, attached near the free end of the right fallopian tube. This little cyst is described by Virchow under the name of the "terminal hydatid:" it is a normal, but by no means constant structure, and is the homologue of the vesicle of Morgagni which appears as an appendix to the head of the epididymis.

The next subject was a lecture on the anatomy of the human eye, given by Dr. J. G. Richardson.

**Sections of Hard Tissues and other Substances for the Microscope.**

BY CHRISTOPHER JOHNSON, M. D.

As hard substances cannot be examined microscopically in their natural state, they must undergo preparation by the investigator before the secrets of their physical and vital condition can be mastered. The end or object of this "preparation" is the production of a lamina so thin as to be translucent, and yet sufficiently thick to retain every physical characteristic. To accomplish this desired end much patience is called for in each of the several processes especially adapted to the particular and different states of hardness, with or without brittleness, or toughness, and finally to the condition of preservation of objects, whether recent or fossil.

It must be evident to every student in microscopy, that certain qualities of objects oppose a barrier to the facile disentanglement of their web and woof, and such, for example, is the absorption of light, as totally by black or partially by colored bodies. Wherefore a knowledge of these qualities is requisite; and success will reward the operator in proportion as he adapts modes of preparation to tissues offered for examination, if he possess the amount of skill and patience indispensable in delicate manipulations.

It may be observed, before proceeding to develop any method of section making, that perfect sections, even, of some objects, such as biliary and vesical calculi, as well as certain pathological concretions, require the aid of a suitable mounting before their intimate constitution can be exhibited; so that the work of the microscopist does not always end with the production of a successful section, but must not be regarded as complete until the preparation be secured and displayed in some proper way upon a slide.

When I needed the aid of guides in directing my unskilled manipulations I was very often embarrassed by the meagreness of the assistance afforded by authors of works on practical microscopy; inexperienced readers, however, will find in my attention to detail that help which will secure me exoneration from the charge of tedious minuteness, and I beg to add that I theorize in nothing, but give the results of my own personal experience.

Hard substances may be divided into two groups, the *first* comprising all such as require the emery wheel for their reduction, and the *second*, all other and less resisting structures. Among the former are to be found the flints and siliceous petrifications, as also very hard calcareous bodies, whether petrifications or of recent and normal constitution, as the porcelain-like shell of many molluscs. In the *succeeding* group may be ranged recent or non-silicified teeth and bone, calculi of various kinds, brain sand and calcareous deposits, hard seed capsules, and the like. Whatever be the process employed to subdue these refractory substances, the resulting section must possess certain qualities or fulfil certain conditions. It must be perfectly flat, of suitable and equal thinness, and ought, if possible, to be polished on both sides. I say if possible, because there are many hard and tough substances which are not susceptible of a polish; and it is almost needless to add that, in the study of structure, sections cut in several directions are indispensable for its correct appreciation.

The apparatus I have employed is of very simple description. For the preparation of sections of objects of the *first class*, I necessarily have recourse to the lathe fitted with a "true" disc of thin soft steel, for emery on the side or edge, as I might wish to grind a surface or cut a slice; with an Ayrshire stone for grinding, and a wooden disc cut across the grain to bear the polishing powder, the tin powder in use by stone cutters. But to save time I have frequently availed myself of the steadily revolving fine stones in a glass-cutting establishment, which readily "cut" the chalk-flint by which they are sharpened and corrected. The lathe is a part of a former watch-maker's, and similar to those commonly in vogue with dentists. The emery

I use was sorted by elutriation, a process indispensable before applying it to the production of an acceptable and polish-bearing surface. This method consists in shaking up good flour of emery with water in a tall cylindrical jar, suffering the whole to stand in repose for, say, two seconds, and pouring off into another jar the fluid overlying the sediment. The original deposit may again be treated in the same way, and when the water shall have been added to that first removed, the residual powder is collected, dried and labelled 2'' emery.

The finer particles withdrawn in suspension into the second jar are shaken up afresh, allowed to deposit for three seconds, are collected, dried and labelled 3'' emery; while the finest dust, which subsides very slowly in the decanted water, may be gathered as 5'' or 10'' emery, the last being fine enough for polishing.

For most purposes large portions of hard objects destined for microscopic examination are unnecessary; and besides, the grinding and other preparation of extensive slices involve a useless expenditure of time and patience. Small sections made from fragments or pieces cut off by wheel from a cabinet specimen are altogether satisfactory—indeed, chips flaked off with adroitness are oftentimes extremely useful in directing investigation, and may even bear mounting as permanent objects.

As small particles or pieces cannot be readily manipulated in their independent state, it is necessary to secure them in such manner as to insure the success of their skillful reduction. This may be done by attaching them singly by shellac or hardened balsam to pieces of heavy mirror glass of about an inch in diameter and ground smooth on the edges. Thus fastened a good surface may be obtained for one side. Then the object must be turned over and again cemented by heating the shellac as before, and pressing the prepared surface flat against the glass. Now, as the grinding progresses the qualities of the section become apparent, and the degree of thinness determined by direct inspection of the section under the microscope.

Large sections, as of shells, can be made with as much precision as smaller ones; but no one can hope to emulate the late Mr. W. Glen, of Cambridge, unless he have extraordinary skill, coupled with most extensive experience.

As to the manner of working the lathe and its wheels, I feel obliged to refrain from speaking; for nothing but repeated essays with that instrument, or personal instruction of an adept, can assist the beginner more than the bearing in mind of a few rules of universal application. *First*, produce and even, steady and not too rapid motion of the disc; *second*, charge the wheel, whether side or edge with a moderate quantity of emery or diamond dust,

wards attached by moderately hard balsam to the slide on which it is to remain, and the final surface will be reached by a repetition of the process of grinding. And here I would call attention to some points in the manipulation, which are that in reducing any substance to the condition of a lamina, it should be poised securely with the fingers, whether it be free or cemented upon glass; propelled along the face of the hone with a long, even and steady sweep; and turned repeatedly upon its horizontal axis. A polish may be given or not, according to the nature of the substance, and the section may be regarded as finished if it bear a satisfactory examination under the microscope. And it should not be forgotten that many specimens are best prepared by working them up to the power under which they are destined to be studied.

Hardened organic substances, as the crystalline, do not bear the heat necessary for attachment to a glass slide, wherefore the second surface must be produced by fixing the first surface upon a bit of white wax by gentle pressure.

Finally, after the grinding shall have been completed, it will be necessary to clean the slide with water; and after drying, to wash away the powder and debris adherent to the surrounding film of balsam with chloroform passed lightly over the slide by the finger covered with soft linen, or, if the section will endure such treatment, the whole of the margined balsam may be cleared away by pouring over the slide a stream of chloroform. But turpentine should be used to detach a finished section from wax.

To mount such sections it will be found advantageous to moisten them with turpentine before dropping on the thin balsam. The cover glass is to be applied warm, and a small weight, as an inch or even a half inch screw placed on it as eventually to press out superfluous balsam. I say eventually, because such slides are unfit for use for several weeks.

When the balsam shall have become sufficiently tenacious the slide may be cleaned by passing a knife blade, held flat, from the cover glass into the circumvallate cement, and then boldly away over the slide. What remains is to be removed with a solution of caustic potash, which itself calls for a free watery ablution, and then the slide needs nothing but the label.

This method of mounting sections is applicable to a great variety of objects, and will be found to yield the best results in the case of urinary crystals, of the so-called hematin crystals, or of the chitinous skeletons of insects as actually practised by the incomparable Mr. T. W. Starr, of Philadelphia.

The preparation of objects of the second class is attended with difficulties, some of which are to be overcome by means similar to those employed in manipulating objects belonging to the former, and some, by reason of the nature of the objects themselves, are to be surmounted by a resort to various expedients. Thus, sections of spines of Echinodermata, as also of biliary and other calculi, may be made in the same way as sections of harder substances; that is, by grinding down a true surface by means of fine silex and finer pumice with water, fixing that side, when dry, upon a slide with Canada balsam hardened until it has become very "tacky," and then finishing the second surface in the same manner as the first. But the calculi, generally, must not be removed from the slide, although the marginal balsam may be cleaned away by drops of chloroform; and they must be covered with soft balsam in situ and so covered. The spines, however, may and must be entirely cleaned by repeated drops of chloroform, in which they are to be floated away from their early attachment; whereupon the slide being wiped clean in the middle, the section is to be floated back to the central spot, suffered to dry, then moistened with turpentine, and immediately overflowed with soft balsam. Heat may or may not be employed before applying the cover glass.

The trick of sectionizing a very small spine of Echinus, or similar object, consists in perforating a disc of a large spine, saturating it with hardened balsam, and inserting the capillary spine into the perforation, aided by heat. The two substances ought to be the same. Now grind down the large piece; and when finished and washed out, find, separate and mount the particle.

But structures such as recent teeth and bone, the hardened albumen of kernels of such nuts as that of *Phytalephas macrocarpa*, brain, sand, &c., bear heat indifferently. They crack, but more provokingly warp, when attempts are made to fix a first surface. Indeed, when not properly dried after the performance of the first step of the process already described, they usually warp so much as to render the making of a uniformly thin section impossible. To remedy the defect of the heat process I found a matter of much difficulty; so I employed a new one, which I claim to be easy, certain and original.

To make sections by the method I have so successfully employed but little apparatus is required. A couple of Arkansas bones, the one coarser, the other very fine, and both kept flat by rubbing upon a hard marble flag with flour of emery and water, are of first necessity. I also recommend that the bones while being "faced" should be pushed steadily along diagonally, first one way and then the other, so that the surface will be "set" or finished continually.

In the next place I mention fine Russian isinglass for glue, to be boiled, strained, and dried in flakes upon a polished metal surface. Then thin letter paper is to be provided; several bits of thick mirror glass, for holders, ground on the edges, of different sizes, from one inch square upwards, according to the size of the projected section, as also sweet oil and a little chloroform. And finally there will be needed some alcohol, and a small quantity of eleutricated polishing putty, oxyd of tin, as used by stone cutters.

As a preliminary it is desirable that some definite idea as to the plane of the section be entertained, and this is possible for all except minute fragments. Then the saw cuts out a small block, say of one-eighth inch in thickness, or the file reduces a mass to near the desired level. Now the object is moved steadily and rather lightly along over the coarser bone, wet with water, and then over the finer one, the operator being careful to pass the object evenly backwards and forwards, to turn it about from time to time, and to examine the surface frequently with a lens to detect invidious scratches. Teeth and similar objects should be pushed along in one direction only, the enamel forward in the case of teeth, so as to avoid and prevent separation of their different constituents.

When a perfect surface shall have been obtained let the specimen be washed in water and then immediately dropped into alcohol, which, abstracting water from every part alike, dries the object—so far as aqueous wetting is concerned—and no warping occurs. Next, strain a bit of chamois skin upon a block, sprinkle upon it a little of the polishing powder, moisten all with alcohol, and polish the first surface by rubbing it with gentle force



it much surpass the contour of the specimen, otherwise difficulty will be experienced in grinding the second surface.

In ten or twelve hours remove the binding string, and with a fine saw cut away a portion of the block of matter, or with a file rasp down the adherent piece. But here again method is everything; for a tooth, for example, must be filed from the enamel towards the ivory, otherwise separation will occur. And the same rule is to be observed in grinding down to the second surface.

In once more resorting to the hones, which, by the way of reminder, ought from time to time to be dressed afresh after the manner already pointed out, it becomes apparent that oil and not water should be used to moisten and clean the surface. Consequently, the second grinding is done in oil, and in perfect safety, for as that fluid exerts no influence upon the glue, the section is retained in position upon the glass throughout the process. When, at length, the desired thinness is reached, it will be perceived that the guide papers as well as the section lie equally close upon the surface of the "trued" fine hone, and that they somewhat resist the action of the stone; and the ground edge of a clean slide applied across the face of the holder will assure the equal thickness of the guide papers and the section itself. If an attempt be made to push the operation farther the holder will be found to adhere somewhat tenaciously to the hone.

The holder must now be carefully wiped clean on all sides; whereupon, after careful examination of the surface for scratches, a polish is to be given. But scratches may be ground off with caution, or suffered to remain if they do not compromise essential parts of the specimen.

With a bit of fine silk stuff borne upon the finger end, and moistened with oil, take up a little of very fine polishing putty, and rub the adhering section quickly as well as briskly, for no heat must be evolved by continued friction, otherwise portions of the specimen will rise in consequence of warping, and be broken off; or else the polish may be given by means of a small bit of chamois skin fastened upon the end of a phial cork, dampened with oil, and armed with polishing powder.

Again wipe off the holder with clean soft cambric; then with the same charged with alcohol; next wash the holder rapidly in soap and water, using the finger the while; pour clean water over section and glass, and finally deposit the holder in a glass dish filled with clean water.

Here let us pause while the water is detaching the section from the paper, and softly liberating the unbroken contour of its margin. The guides are set free, the subjacent paper quits the holder, and the section is left alone by the withdrawal of both paper and glass.

Before proceeding further I desire to show how sections of very slender rods, spicules, or teeth, such as those of the Bat, may be prepared with facility. As these minute or delicate objects cannot be held by the fingers, the expedient of glueing them to larger objects must be resorted to. But to secure equality in the grinding, the two structures, the supporting and the supported, must be the same. Thus, tooth must be attached to tooth, bone to bone, &c. And as very fragile cancellated tissue will hardly bear the friction of the hones, the meshes are to be filled up with isinglass glue, and the specimen dried before the saw or the hone can be employed. Such specimens must be ground in oil for the first surface; after which, when wiped off and robbed of this oil by maceration in chloroform, they may be cemented with glue upon the paper-faced holder, and the production of the second surface is accomplished after the manner already pointed out.

The support afforded to cancellated tissue by isinglass in the class of objects at present under consideration may be found equally in hardened Canada balsam for objects of another sort. The spines of some Echinoderms are so brittle as not to endure handling in their natural state, but the most ghostly of these, such as the hollow spines of *Diadema*, may be readily and safely held and subjected to the process of grinding if their cancelli be filled with hardened balsam, introduced, of course, while hot. And, to repeat, these small bodies

must be cemented upon larger ones of the same kind if anything like truism in the plane of the section be attempted or required.

Our specimen exists, but is still unfit for mounting, because it is saturated with oil and retains small particles of the putty. To rid it of the latter it may be removed to a slide by forceps, or, if too delicate, must be floated on the water by tilting the vessel, and then dipped up on a slide. A camel's hair pencil full of water readily washes away all particles of paper or dust, especially if the lamina be held upon the slide by the flattened end of a match stick; and the other surface, being made uppermost by turning in water, is to be prepared in the same way. Once more drop the section in water; then with fine forceps remove and let it fall into the alcohol; now transfer it to chloroform; and finally place it between bits of smooth bibulous paper, which again lie between a couple of clean slides. A pair of spring forceps will maintain flatness until the now finished section is required for mounting.

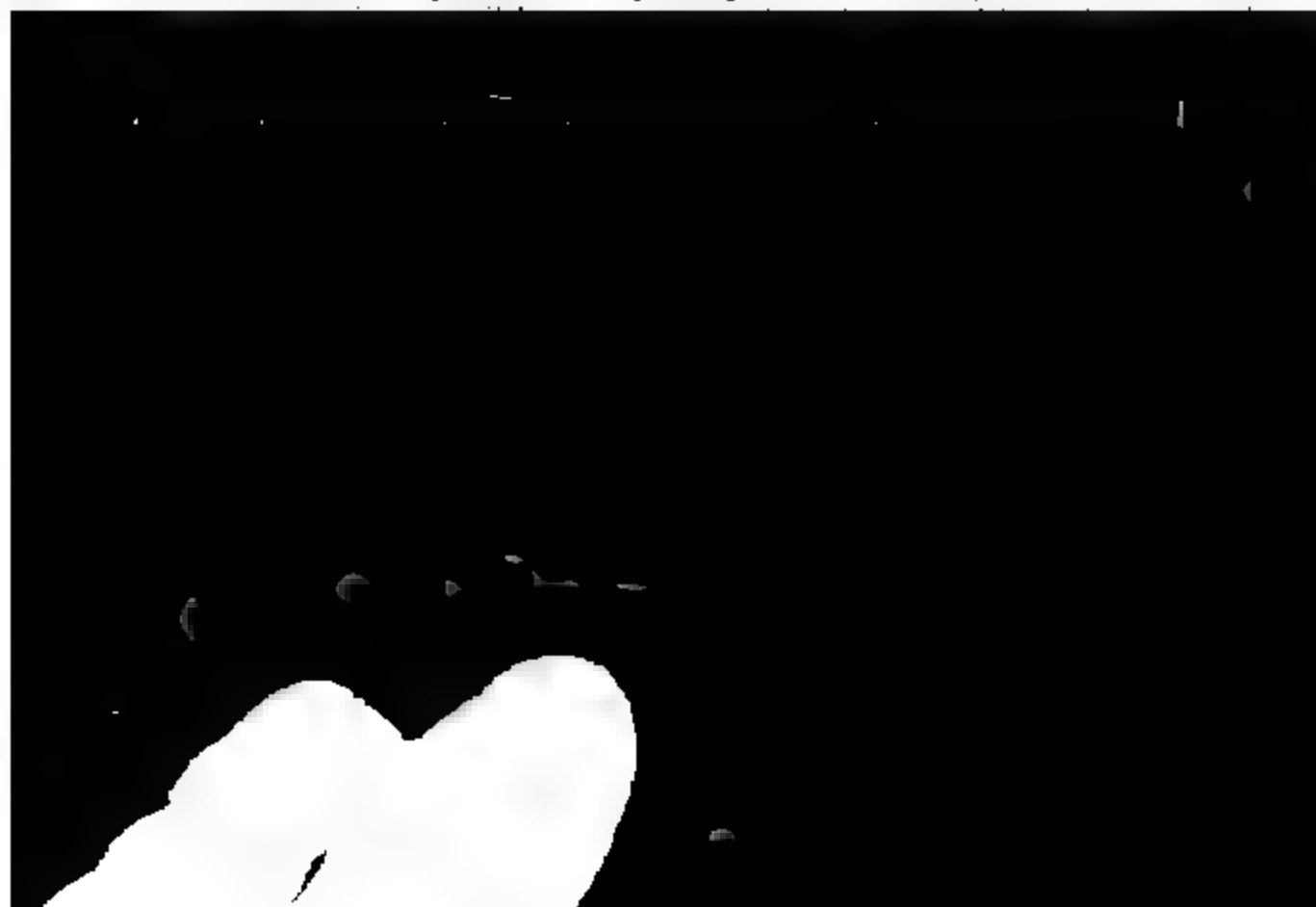
After so much trouble it were a pity to lose a fine specimen by bad mounting; wherefore, and to prevent a loss of time and labor and much disappointment, I beg leave to offer a few suggestions as to the manner of caging or embalming the result of our successful efforts.

In any case choose the better side of the section as the uppermost, and this is commonly the first. Have ready, for the *dry method*, a slide cleaned with dilute alcohol, and upon it a shallow circle of shellac, applied in alcoholic solution by the aid of the Shadbolt turn-table. The shellac should be nearly hard after a day's exposure. Wipe the slide with dry cambric over the circular area, and clean a suitable cover glass which has been lying in dilute alcohol. Warm the slide over a flame of a spirit lamp to drive off moisture; suffer it to cool perfectly; place the section in the cell; warm and cool the cover; lay the latter upon the cell; on the cover put a bit of thin paper, and over this a piece of a slide, finally clamping all together by spring forceps. The slide must be held over the spirit flame until the softened shellac adheres all around the circle to the cover and the section is pressed and held flat.

When cold, the work is done.

The embalming process, like the one just described, requires a little practice to ensure success. As soft balsam pervades almost all structure, it is generally inapplicable to the mounting of tissues, such as bone and tooth. At any rate I have already spoken of the manner of its use. But where tubuli, &c., are to be made conspicuous by retained air, hardened, not hard, balsam must be employed.

To mount a section in such balsam I proceed as follows: On a slide free from crocus-flaws pour a small quantity of soft balsam, and hold the same



the surfaces are exposed alternately to the heat of the spirit flame sufficiently to melt the whole balsam. All superfluous balsam now runs out between the principal slide and the paper, and usually bears with it the air-bubbles, so that the section remains perfectly flat, and embedded in the smallest possible quantity of balsam.

When perfectly cold the upper slide may be removed, the paper readily stripped off, and the mounting is accomplished.

To clean off the marginal hard balsam with a hot knife-blade, to clear away residual streaks or border, and to wash to brightness both surfaces of the slides with aqua ammonia on a bit of rag, occupy but a few minutes; and nothing remains to be done but attach the label duly inscribed.

There are those who prefer to ornament the edge of the cover with black varnish, which certainly gives a pretty appearance to the slide; but I would recommend the previous protection of the margin of balsam below it by a thin coat of shellac varnish, which effectually prevents penetration of the black into the balsam, whether soft or in a hardened condition.

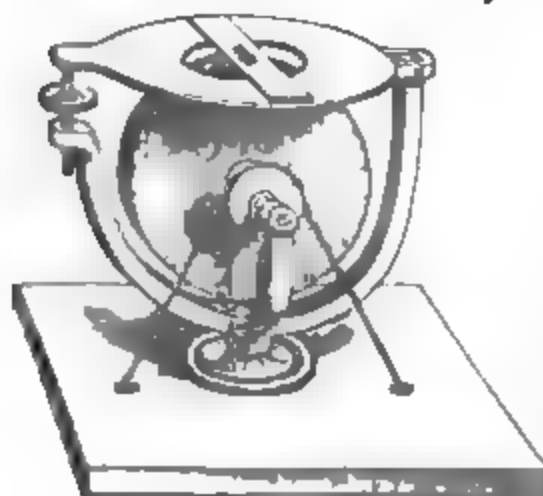
In reviewing this paper, I do not seek to excuse its prolixity, but to express the hope that the methods and processes described in it may obtain the approbation of others; and that they may continue to give the very excellent results which have rewarded my labors, as well as of those friends who have accepted my guidance in microscopical studies.

This paper was accompanied by thirty-eight preparations for exhibition, including sections of teeth, shells and calculi.

#### **Description of Machine for Grinding Sections of Hard Substances for Microscopic Purposes.**

BY COLEMAN SELLERS.

The preparation of thin sections of hard substances, such as bone, teeth, stone, &c., for microscopic purposes is usually attended with more or less trouble, and requires considerable skill on the part of the workman. The chief difficulty is in securing uniformity of thickness in the specimen. A machine lately devised by Mr. J. S. Bancroft, of Philadelphia and in use at the establishment of Messrs. Wm. Sellers & Co., embodies a principle which, applied to this purpose, facilitates the operation. This particular machine is one of those improvements in the direction of enabling unskilled labor to take the place of skilled labor, or to enable skilled workmen to do a greater amount of good work in the same time. It is a well known fact that patient industry combined with mechanical skill will enable marvels of good workmanship to be produced, but those inventions are the most valuable which with the least outlay of capital in costly machinery enables unskilled workmen to produce the same result more expeditiously and if possible more perfect. The contrivance of Mr. Bancroft was designed to produce a truly plane surface on hardened metals. It consists of a plane metal table, the upper surface of which is made accurately true. This plane surface or plate rests on



hinges at one end and is provided with an adjusting screw under the other end. In the middle of the table is an oblong rectangular slot, say one inch wide, so arranged as to allow the edge of an emery wheel placed below the table to project slightly above the surface of the plate. The emery wheel, supported in suitable bearings, is made to revolve rapidly on its axis, and its periphery becomes an abrading point in the centre of the plane surface of the metal plate. By means of the regulating screw the plate can be so adjusted as to determine the distance that the edge of wheel shall project above

the plate. In use, the hardened metal to be ground true is pressed firmly by the hands of the workman upon the plate, and passed with a sliding motion in various directions over the wheel. The emery wheel touches the highest places, and gradually reduces all to one uniform plane. With this machine straight edges of hardened steel have been produced of such perfection that when pressed together on the edges the one will lift the other by cohesion, without the intervention of a fluid.

This machine suggested to me an application of the same principle to the preparation of microscopic objects. For the large plane table with the narrow opening in the machine, as described, I substitute a small plate of brass or iron, with a circular opening in its centre of about  $1\frac{1}{2}$ " diam. The emery wheel is supported on a spindle and stand, such as can be purchased at any of the dental depots, and intended for the purpose of rotating emery or corundum wheels, &c. The table hinged above the wheel has an adjusting screw to determine the height of its surface plane above the edge of the emery wheel. In use, the specimen, ground and polished on one side, is then mounted with hard balsam on the glass slide upon which it is to remain. It may then be roughly ground down or filed down to any convenient thickness short of that actually needed; then it is laid upon this grinding machine (specimen down), the slide resting on each side of the centre hole in the plate, the specimen touching the revolving emery wheel. Passing it back and forth over the wheel, it is reduced to a plane parallel with the glass upon which it is cemented, and its final thickness regulated by the adjustment of the table. When thin enough for the purpose intended it may be smoothed with a slip of Scotch stone and polished without fear of destroying the uniformity of thickness obtained by the section-grinding machine. In using the instrument in the preparation of sections of ivory or bone I have found that the grinding should be done with either a dry wheel or one moistened with oil, as water will swell the specimen and crack it loose from its cement. The wheels used by me are made of emery and glue, not the shellac corundum wheels sold at the dental depots. It is probable that a circular file, i. e., a steel wheel with teeth on its edge, would do well as a grinding wheel for bones, in place of the emery wheel.

---

D. H. C. Wood exhibited slides of mycelium filaments and spores of a fungus, which were found disseminated throughout a crust or scab, similar to others expectorated at different times during the past six months by a gentleman, who had sent the crust to Prof. Leidy. Dr. Wood promised to investi-



*Sept. 6th, 1869.*

Director, S. W. MITCHELL, M.D., in the Chair.

Nineteen members present.

The Director, for the committee appointed at last meeting on Dr. Keen's paper, reported that they had asked Dr. Keen to make some further experiments.

Dr. Keen read a supplement to his paper, in compliance with this recommendation.

Dr. Tyson read a paper entitled, "a Note on the Distribution of Nerves to the Vessels in the Connective Tissue of the Pig's Kidney." See Amer. Jour. Med. Sci., Oct., 1869.

Dr. W. Pepper exhibited some slides of muscular fibre removed, post-mortem, from an emigrant girl, who died of typhoid fever.

The patient was a German girl, æt. 22, who had been in America but six weeks. There had been six deaths from fever on board the emigrant ship in which she came to this country. She died on the nineteenth day.

Besides the ordinary lesions of the disease, the muscular tissue of both ventricles of the heart presented a marked degree of friability, and, on microscopic examination, was found to have undergone quite advanced granular degeneration, as originally observed by Zenker.

The psoas and external oblique muscles of the right side were also examined, but were found healthy.

DR. HOWELL made some remarks on the application of photography to microscopy. He spoke of the inexpensiveness of the apparatus necessary to the work, and exhibited the results of his experiments with sunlight, and also the magnesium light, as applied to micro-photography. The positive prints were from photographs of sections of teeth, bone, cartilage, coal, &c.

DR. H. ALLEN made some remarks upon the peculiarities in the construction of inter-orbital space of the human skull. He demonstrated by outlines upon the blackboard that these peculiarities may consist of the following plans:

(1.) Absence of nasal bones with vertical plate of ethmoid appearing between the nasal processes of the superior maxillæ.

(2.) Absence of left nasal bone, its area being occupied by the nasal process of the corresponding side.

(3.) Same as (1), with rudiments of nasal bones in position.

(4.) Ossification of inter-nasal septum.

Reference was made to Dr. Van der Hoeven's paper on this subject in Siebold and Kölliker Zeitschrift.

---

*Sept. 20th, 1869.*

Vice-Director, W. PEPPER, M.D., in the Chair.

Twenty-two members present.

Dr. J. G. Richardson exhibited specimens of *Sarcina ventriculi* found in the vomited matter of a patient.

He remarked that his observations tended to show that the divisions of the *Sarcina* which were formerly figured by some as having central nuclei, are now seen, under a higher power, to be divided into four parts, the junctions of their separating fissures being apparently mistaken for their nuclei.

Dr. Wm. Pepper desired to place on record the following observations:

<i>Triploceras gracile</i> , Bailey.	<i>Staurostrum Lewisii</i> , sp. nov.
<i>Triploceras verticillatum</i> , Bailey.	<i>Staurostrum munitum</i> , sp. nov.
<i>Euastrum ornatum</i> , sp. nov.	<i>Closterium angustatum</i> , K.
<i>Euastrum elegans</i> (Bréb.), Ketz.	<i>Closterium juncidum</i> , Ralfs.
<i>Euastrum Ralfsii</i> , Rabenh.	<i>Closterium striolatum</i> , Ehr.
<i>Euastrum multilobatum</i> , sp. nov.	<i>Xanthidium armatum</i> , Bréb.
<i>Cosmarium Brebesonii</i> , Menegh.	<i>Xanthidium</i> , sp. ?
<i>Cosmarium commissurale</i> , Bréb.	<i>Microsterias furcata</i> , Ag.
<i>Cosmarium cucumis</i> , Corda.	<i>Arthrodesmus quadricauda</i> , n. sp.
<i>Cosmarium suborbiculare</i> , sp. nov.	<i>Penium digitus</i> (Ehrb.), Bréb.
<i>Staurostrum arachne</i> , Ralfs.	<i>Bambusina Brebesonii</i> , Ktz.
<i>Staurostrum paradoxicum</i> , Meyen.	

The doctor called attention to the fact that whilst in this neighborhood one rarely met with a desmid which was provided with large granules or spines; in this northern collection by far the majority of the specimens were so provided. Of *Cosmarium commissurale*, Bréb., Dr. W. stated he had only seen a single specimen, and this differed from the typical form in having the sinus very narrow in its outer portion, and in being shorter, but these differences did not seem enough to justify specific separation. Of *Closterium angustatum*, also, but one specimen had been found, which agreed very well with the typical forms, except that it was a little narrower, its greatest breadth not being more than  $9-12000'' = .00075''$ .

The desmid which the doctor referred to *Euastrum Ralfsii* he stated to differ considerably from the typical form in the proportion of the breadth and length. There are also certainly four, if not more, umbonations on the face of each half-cell. These are nowhere distinctly spoken of as existing, and Mr. Archer, in Pritchard's Infusoria, states there are none visible in the front view of *E. Ralfsii*. They are, however, represented in the side view of the original figure, and are said to be very noticeable by Mr. Archer himself, when the desmid is so looked at. In the Saco Lake specimens they are always seen in the front view with great difficulty, and in some cases I failed entirely to demonstrate them, so that they do not afford a good character for the indication of a new species.

#### **EUASTRUM MULTILOBATUM, sp. nov.**

*E. magnum*, fere duplo longius quam latum, medio profunde constrictum, et cum sinu modice amplo; a latere medio ventricosum et duplo biumbonatum, ad verticem dilatatum et emarginatum; semicellulis a fronte trilobatis, lobis

**ECASTRUM ORNATUM, sp. nov.**

*E. oblongum*, diametro duplo longius, profunde constrictum, sinu angusto lineari; semicellulis a fronte trilobatis; lobis basalibus latissimis, nonnihil sinuato-emarginatis, angulis plus minus productis et rotundatis; lobo polare medio profunde lineare inciso, segmentis late rotundatis; semicellulis a latere bilobatis, lobis basalibus profunde emarginatis et cum angulis plus minus acutis; cytiodermate distincte ordinatim punctato.

*Diam.*— $35-12000'' = .00029$ .

*E. oblong*, twice as long as broad, profoundly constricted; semicells from the front trilobate; basal lobe very broad, slightly sinuately-emarginate, angles more or less produced and rounded; polar lobe medianly profoundly linearly incised, segments broadly rounded; semicells bilobate at the sides, basal lobes profoundly emarginate and with the angles more or less acute: cytioderme distinctly regular punctate.

*Remarks.*—This species is close to *E. crassum*, from which it differs in the proportionate length, being only twice instead of three times as long as broad; in the size being only three-fourths as large; and especially in the peculiar lateral splitting, as it were, of the basal lobes.

**ARTHRODESMUS QUADRIDENS, sp. nov.**

*A. late ovali*, vel suborbicularis, paulum longius quam latum, cum margine crenato-undulato; semicellulis nonnihil reniformibus, utroque fine aculeo subulato, modice robusto, acuto, recurvo, armatis; cytiodermate cum verruculis paucibus modice minutis in seriebus paucibus dispositis instructo; semicellulis a vertice acute ellipticis, et cum margine crenato et superficie sparse verruculosa.

*Diam.*—*Lat.*  $3-4000'' = .00075$ ; *long.*  $5-4000 = .00125''$ .

Broadly oval or suborbicular, a little longer than broad, with the margin crenately undulate; semicells somewhat reniform, at each end armed with a subulate, moderately robust, acute, recurved large spine; cytioderm with a few smallish tubercles arranged in three or four rows; semicells from the vertex acutely elliptical, with the margin crenate and the surface sparsely warty.

*Remarks.*—This species approximates *A. divergens*, from which it differs in the arrangement of its granules, its attaining not one-half the size, and, I believe, in the larger and more robust spines.

**STAUSTRUM MUNITUM, sp. nov.**

*S. submagnum*, fere  $\frac{1}{2}$  plo longius quam latum, medio leviter constrictum; semicellulis a fronte enormiter hexagonis, angulis in processus rectis et divergentibus productis, dorso processibus similibus 4—5 instructo; semicellulis a fronte polygonis vel suborbicularibus, margine processibus numerosis, plerumque 9 instructo; dorso processibus 5—8 instructis; processibus omnibus similibus granulato-dentatis, apice achroo simplicibus, bifurcatis vel fissis.

$25-12000'' = .002$ .

*Diam. a vertice cum processibus.*— $51-12000'' = .00475$ . Sine process.

*S. rather large*, about one-half longer than broad, slightly constricted in the middle; semicells from the front irregularly hexagonal, the angles prolonged in straight divergent processes, and the surface furnished with four or five similar ones; semicells from the front polygonal or suborbicular, the margin furnished with numerous processes, mostly about nine, and also with 5—8 on the dorsum; processes all similar, granulate-dentate, their transparent apices simple, bifurcate or torn.

*Remarks.*—This species is most closely allied to *St. fuscigerum*, Bréb., from which it is at once distinguished by the orbicular vertex. The constriction between the semicells is also very different. In *St. munitum* it is a gradual, not very deep, hour-glass contraction; in *St. fuscigerum* it is very narrow and linear.

**STAUROSTRUM LEWISII.**

*S. leve*, sinu amplissimo, spinulo parvo armato et cum angulo obtuso; isthmo nullo; semicellulis a fronte late triangularibus, a vertice triangularibus et cum angulis nonnihil tumidis, et rotundatis; angulis spinulo maximo, robusto, acuto armatis.

*Diam.*—Long. cum spin.  $1.400'' = .0025$ ; lat. cum spin.  $27-12000'' = .00225''$ . Sine spin.: long.  $1.600 = .001666$ ; lat.  $13-12000 = .001666$ . Spin.: long.  $1-1500 = .000666$ .

Smooth, with a very ample sinus, which is armed with a small spine and has a very obtuse angle; isthmus absent; semicells from the front broadly triangular, from the vertex triangular, with the angles somewhat tumid and rounded; angles armed with a very large acute robust spine.

*Remarks.*—This desmid is most closely allied to *St. aristiferum*, Balf., but differs from it in outline as seen from the front, there being no mamellation of the ends. The spines in the sinuses are also wanting in the European species.

**COSMARIUM SUBORBICULARE, sp. nov.**

*C. parvum*, suborbiculare, paulo longius quam latum, cum margine enormiter crenato, vel crenato-undulato; semicellulis a latere orbicularibus, a vertice ellipticis; sinu extra angustissimo sed intra nonnihil excavato; cytiodermate crasso, sparse verruculoso; granulis in semicellulis singulis subdistantibus et in seriebus elongatis, duobus (interdum unica) externis curvatis, et in seriebus duobus internis brevibus et rectis.

*Diam.*—Lat.  $14-12000'' = .0012$ ; lat.  $16-12000 = .0013$ .

Small, suborbicular, a very little longer than broad, with the margin irregularly crenate, or crenate undulate; semicells from the side orbicular, from the vertex elliptical; sinus very narrow, but within somewhat excavated; cytioderm thick, sparsely coarsely granulated; granules subdistant, in each cell arranged in one or two curved marginal series and in a central group of two or three short rows.

*Remarks.*—The arrangement of the granules in this desmid is peculiar, one or sometimes two rows of large obtuse pearly granules placed at rather wide intervals along the whole outer margins, and then in the centre of each semicell a group of two or three, or even more short straight rows of three or four similar but rather smaller granules. The isthmus is rather broad and short; sometimes it has on it one or two granules.

*Fig. 1.*—*Staurostrium Lewisii*, showing the shape of the cell.



## Genus TETMEMORUS.

**T. GIGANTEUS, n.**

**T. maximus**, oblongus, diametro 3 plo longior; apice haud attenuato, late rotundato; suturis profundis, linearibus; cytiodermate irregulariter granulato-punctato.

*Diam.*— $24-7500 = .0031$ .

I found this beautiful desmid in a stagnant pool in Bear Meadows, Centre Co., in the month of August. It is very different in its outline from its nearest ally, *T. granulatus*. The diameter is preserved uniform until, at the very end, where there is an alteration in the line of the margin, so as to cause some contraction. This is, however, wanting in some specimens. The ends are therefore broad and obtuse. The size is also double that of *T. granulatus*.

Dr. Mitchell exhibited a perfect egg, with shell, enclosed in a larger egg. The outer egg contained albumen and a partial yolk. The hen from which the specimen was obtained had produced several similar ones.

Dr. W. F. Norris was chosen a member of the Section.

---

*Dec. 6th, 1869.*

Director, S. W. MITCHELL, M.D., in the Chair.

Eleven members present.

Mr. Walmsley donated three preparations of the lung, liver and kidney of the rattlesnake injected.

Dr. S. W. MITCHELL exhibited specimens of *hydrate of chloral* in solid, and in aqueous solution. He had administered hypodermically to a pigeon 10 grains, producing immediate death. Three grains similarly administered resulted in death at the expiration of between two and three hours; the pigeon having, however, several times apparently expired before death actually took place. To a rabbit 15 grains were administered hypodermically, death occurring in an hour. In each instance, rigor mortis supervened rapidly.

The election for officers for the ensuing year was held, which resulted as follows:

*Director*, S. W. Mitchell, M.D.

*Vice Director*, Wm. Pepper, M.D.

*Recorder*, Jas. Tyson, M.D.

*Treasurer*, C. N. Pierce, D.D.S.

*Curator*, W. H. Walmsley.

*Publication Committee*.—Recorder, *ex off.*, Chairman; F. W. Lewis, M.D.; W. Pepper, M.D.; M. W. McAllister; W. S. Bolles, M.D.; J. G. Hunt, M.D.

*Curators*.—W. H. Walmsley, *ex off.*, Chairman; J. G. Richardson, M.D.; T. W. Starr; F. W. Lewis, M.D.; W. F. Norris, M.D.

*Auditors*.—H. M. Bellows, M.D.; W. McFadden, J. W. Queen.

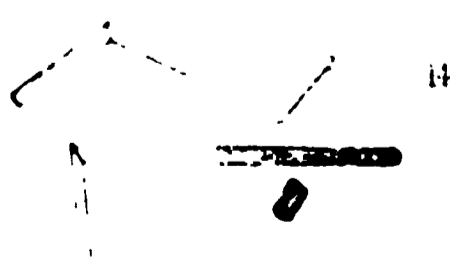
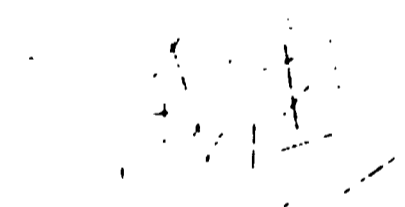
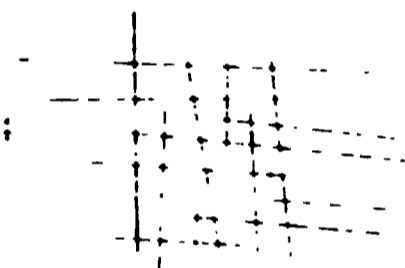
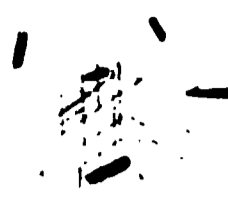
1869.]



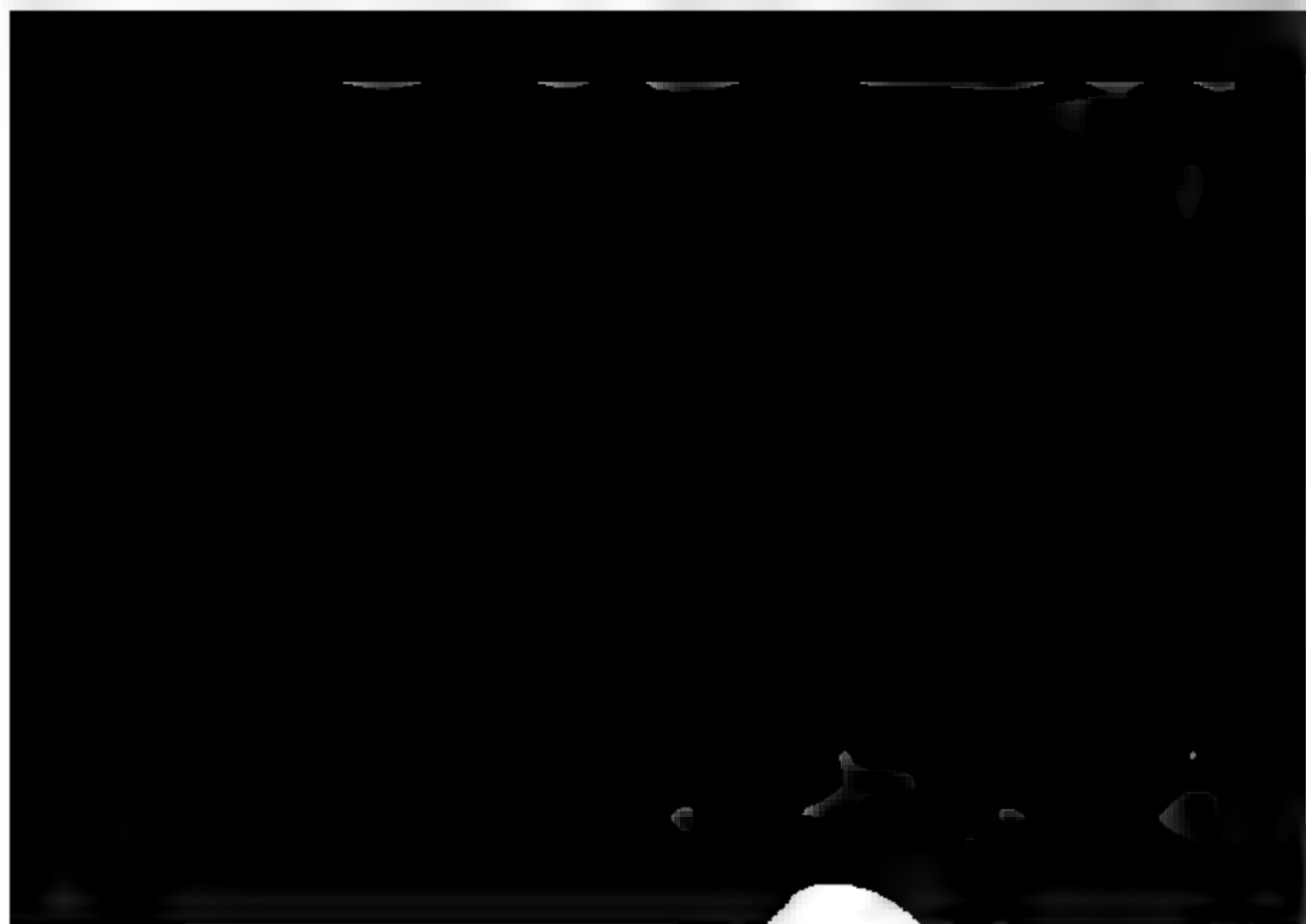
Fig. 1



Fig. 2



MICROSCOPIC CRYSTALS IN GEMS.

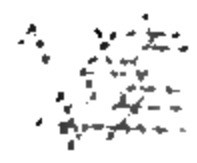
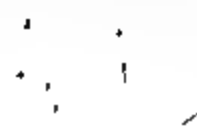
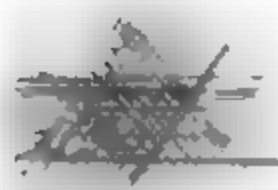


*Proc A. N. S. Phila. 1869.*



*Hyperoodon of Narragansett.*





MICROSCOPIC CRYSTALS IN GEMS



-----

1/2

1/2

1/2

1/2

1/2

1/2

1/2

1/2

1/2



1<sup>st</sup> July 1869.

PL 2



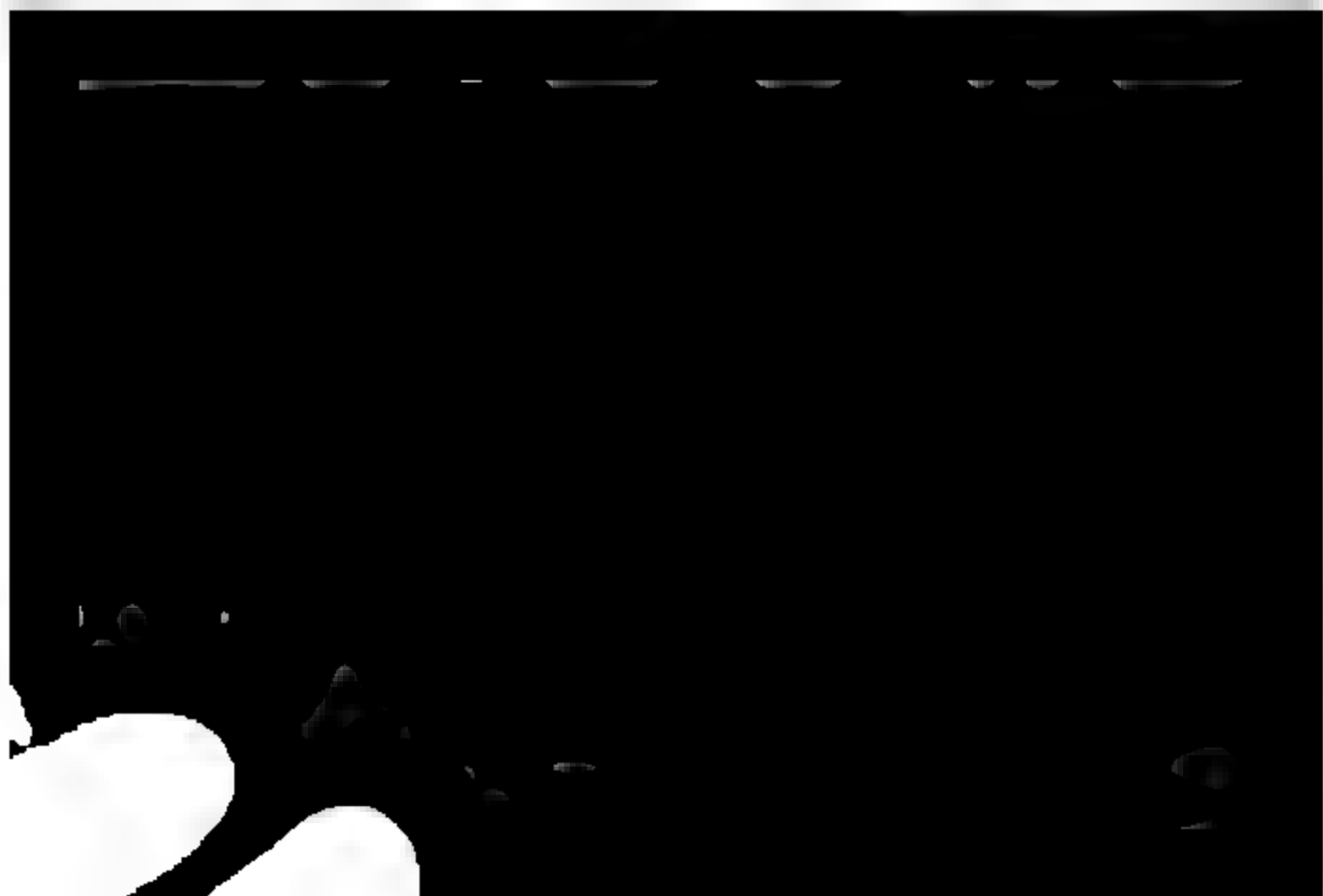
*Hyperodon of Narragansett*



*Proc. A. N. S. Phila<sup>a</sup> 1869.*



*Hyperoodon of Narragansett.*



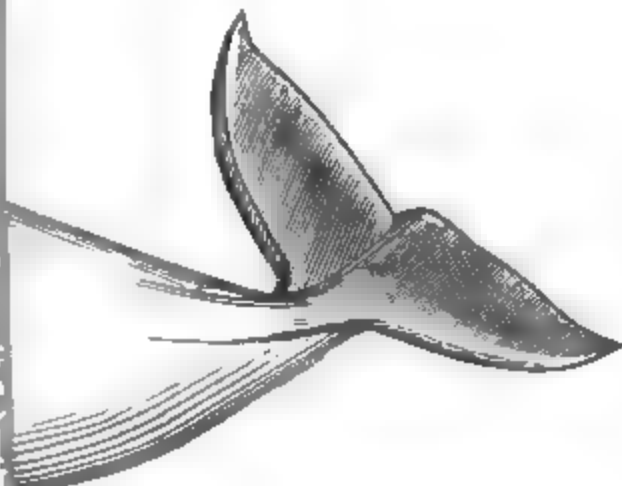
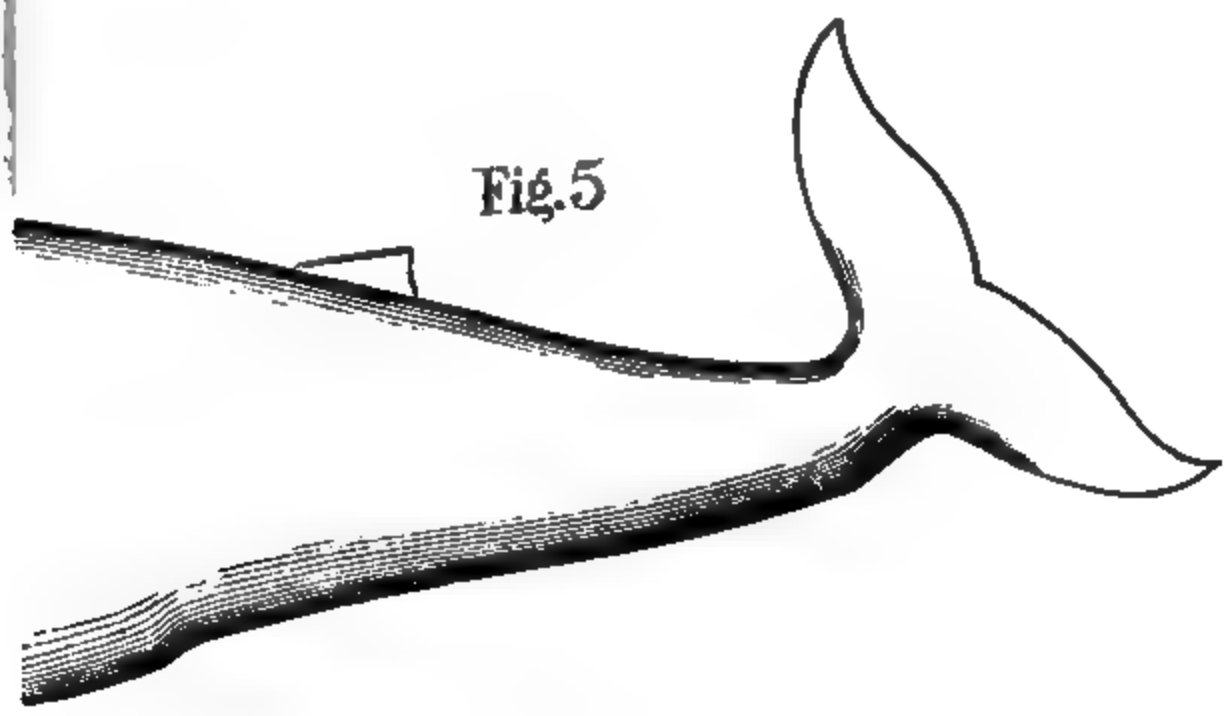


Fig.5





**PROCEEDINGS**

**OF THE**

**ACADEMY OF NATURAL SCIENCES**

**OF**

**PHILADELPHIA.**

---

**1870.**

---

**PHILADELPHIA:  
PRINTED FOR THE ACADEMY.  
1870.**



# LIST OF CONTRIBUTORS,

*With reference to the several Articles contributed by each.*

For Verbal Communications see General Index.

---

<b>Bannister, H. M.</b>	A sketch of the classification of the American Anserinæ.	130
<b>Buckley, S. B.</b>	Remarks on Dr. Asa Gray's Notes on Buckley's New Plants of Texas .....	135
<b>Cope, E. D.</b>	Observations on some Fishes new to the American Fauna, found at Newport, R. I., by Samuel Powell. ....	118
<b>Gill, Theo.</b>	On some New Species of Fishes obtained by Prof. Orton, from the Marañon or Upper Amazon, and Napo Rivers.....	92
<b>Heenan, Thos.</b>	Cross fertilization and the law of sex in Euphorbia.....	14
	On the Flowers of <i>Aralia spinosa</i> , L., and <i>Hedera helix</i> , L.....	107
	On the Stipules of <i>Magnolia</i> and <i>Liriodendron</i> ... ..	114
	Notes on <i>Silphium laciniatum</i> , L.....	117
	Bud Varieties.....	128
<b>Meek, F. B.</b>	Descriptions of Fossils collected by the U. S. Geological Survey under the charge of Clarence King.....	56
<b>Meek, F. B. and A. H. Worthen.</b>	Note on the Relations of <i>Syncladia</i> , King, 1849, to the proposed genus <i>Septopora</i> , Prout, 1858 .....	15
	Descriptions of New Species and Genera of Fossils from the Palæozoic rocks of the Western States.....	22
<b>Ridgway, Robt.</b>	A new classification of the North American Falconidæ, with descriptions of three New Species.....	138
<b>Streets, T. Hale.</b>	Remarks on Huxley's Classification of Birds.....	84
	Notice of some Crustacea of the Genus <i>Libinia</i> , with descriptions of four New Species .....	104
<b>Thomas, Prof. Cyrus.</b>	Descriptions of Grasshoppers from California.....	74



PROCEEDINGS  
OF THE  
ACADEMY OF NATURAL SCIENCES  
OF  
PHILADELPHIA.  
1870.

---

Jan. 4th, 1870.

The President, DR. RUSCHENBERGER, in the Chair.

Thirty members present.

PROF. LEIDY called the attention of the members to a curious fossil, which had been sent to him for examination last fall by Prof. Hayden. It was found in Colorado, and loaned to the latter by Dr. Gehrung, of Colorado City. Prof. L. remarked that when first received, the specimen strongly recalled to his mind the upper part of the face of the wonderful *Sivatherium* of the Sivalik Hills of India. It, however, presents so many peculiarities, that among other conjectures he thought it might have pertained to the pelvis of a chelonian, but had finally concluded that his first suspicion was the correct one. The specimen corresponds with that portion of the face of *Sivatherium* comprising the upper part of the nose together with the forehead and anterior horn cores. As is described to be the case in the corresponding portion of the skull of *Sivatherium*, all the bones comprising the fossil are completely coössified so as to leave no trace of the original position of the sutures. The nasal and contiguous bones are of great thickness, and as solid as those generally of the Sirenians. The animal to which the fossil belonged was nearly as large as the *Sivatherium*.

The horn cores are nearly like those of the latter in form, size, and relative position to each other. They are conical knobs, slightly trilateral, and with an obtusely rounded summit, which is more porous than the bone is elsewhere. They are moderately divergent, and their summits project more over their base externally than in *Sivatherium*. The space between the cores extending across the forehead forms a continuous concavity; and the surface from the end of the nose to the broken border of the fossil posterior to the cores forms a moderate convexity. In *Sivatherium* the corresponding surface from the slope of the forehead to the convex rise of the nasals forms a deep concavity.

The face, as formed by the nasals and their apparent conjunction with the maxilla in advance of the horn cores, is very short in comparison with that of *Sivatherium*. The coössified nasals are proportionately shorter, broader,

[1870.]

and stouter than in the latter animal. Their lateral borders are much more obtuse, and they terminate in a broad, thick, notched point. The ends bordering the notch are most thickened and porous, apparently indicating the attachment of a long moveable snout. The nasals do not rise from the forehead in the vaulted manner so conspicuous in *Sivatherium* and *Rhinoceros*, but, as previously indicated, simply continue the curvature of the forehead.

One of the most remarkable characters of the fossil is the greater extent backward of the lateral nasal notch than in *Sivatherium*. In this it ceases far forward of the position of the horn cores, situated above the orbits. In the Colorado fossil the notch continues back and beneath the position of the horn cores, where the nasals apparently become continuous with the maxillaries. The relative position of the orbits cannot be ascertained, as all the contiguous parts are broken away. They appear to have been situated behind the position of the horn cores.

Several measurements of the fossil are as follows:

Distance from the centre of the summit of one horn core to the other.....	10½ in.
Length of horn cores above level of the intervening space.....	5 "
Length of lateral nasal notch.....	4½ "
Distance from end of nose to centre of space between the horn cores....	6 "
Breadth of nose midway between end and position of horn cores.....	4 "
Breadth of face, where narrowed, below horn cores.....	7½ "

It is probable that the fossil may pertain to the same animal as the remains from the Manvelses Terres of Nebraska, described under the name of *Sivatherium*, but in the state of extreme uncertainty as to its collocation, it may with equal probability be referred to other genera, perhaps to *Megalomys*, or it may have been an American species of the *Sivatherium*. Under the circumstances it may be referred to a new genus, with the name of *Megaceros COLORADENSIS*.

PROF. O. C. MARSH, of Yale College, exhibited a number of vertebrae of a new Dinosaurian from the cretaceous green sand near Barnsboro', N. J. He observed that they indicated a reptile allied to *Hadrosaurus Foulke* Leidy, but only about one half the size of that species. The specimens, although all found in the same immediate neighborhood, were apparently portions of three different individuals, only one of which was fully adult. They consisted of several dorsal and lumbar vertebrae belonging to the Museum of Yale College, and an anterior caudal vertebra recently presented to the collection of the Academy by Dr. Leidy. These remains appear to be quite distinct from those already described, and apparently belong to the same species, for which Prof. Marsh proposed the name *Hadrosaurus minor*. Prof. Marsh also showed the tooth of a new and very large *Mosasauros* from the cretaceous of North

man's Journal he had proposed the name *Halisaurus* for a new genus of Mosasauroid Reptiles, but as *Halosaurus*, essentially the same word, had previously been given to a genus of fishes, he wished to substitute for the former the name of *Baptosaurus*.

Prof. Marsh also showed a tooth of a rhinoceros from the miocene of Squankum, N. J., which was the first authentic evidence of this animal east of the Mississippi River. It was found in the pits of the Squankum Marl Company, in the same layer with the remains of the *Elotherium Leidyanum* Marsh, and was presented to the Yale Museum by Mr. O. B. Kinne. The tooth was the last molar of the left under jaw, and indicated an animal about two-thirds the size of the living Indian species. He proposed for it the name *Rhinoceros matutinus*.

---

Jan. 11th.

The President, DR. RUSCHENBERGER, in the Chair.

Twenty-five members present.

PROF. LEIDY directed attention to some fossils, on which he made the following remarks :

1. A specimen consisting of less than the half of a vertebral body, was submitted to my examination by Prof. Hayden, who obtained it last summer during his geological survey. It is from Middle Park, Colorado, and Prof. Hayden thinks was derived from a cretaceous formation. Similar specimens were reported to be not unfrequent, and were known under the appellation of "petrified horse hoofs." The fossil indicates an elongated form of caudal vertebra of some large saurian. Much constricted towards the middle, such specimens would be most liable to break in this position, and the halves from their form might readily be taken, by the inexperienced in such matters, for what they are called.

The vertebral body in its entire condition would resemble in form those of *Spinosaurus*, but in form and other characters bears a near resemblance to those of *Poecilopleuron Bucklandi*. This is an extinct reptile from the oolitic formation of Caen, in Normandy, described by Deslonchamps; and remains apparently of the same animal from the Wealden of Tilgate, England, have also been described by Prof. Owen.

*Poecilopleuron* has generally been viewed as a crocodilian reptile with biconcave vertebræ, but probably pertains to the dinosaurs. The *P. Bucklandi* estimated by Deslonchamps to have been about 25 feet long. The Colorado fossil indicates a much larger animal, having been more than one-third greater.

One of the most remarkable characters of the *Poecilopleuron* is the presence of a large medullary cavity within the bodies of the vertebræ, paralleled among living animals, so far as I know, only in the caudal vertebræ of the ox. The same character is presented by the Colorado fossil. In the former animal the cavity appears simple or unobstructed by osseous trabeculæ. In the Colorado fossil, as seen in the broken surface of the specimen, the medullary cavity occupies the lower two thirds of the interior of the body and is crossed by a few trabeculæ. The sides of the cavity, converging below, are constituted by a layer two lines thick and as compact as the walls of the medullary cavity in the limb bones of most ordinary mammals. The upper third of the interior of the body is occupied by the ordinary spongy substance which becomes more compacted ascending into the interior of the neural arch. The cavernous structure of the Colorado fossil is occupied with crystalline calcite.

The estimated length of the vertebral body is six inches or more. The sides are much narrowed towards the middle, and they are concavely depressed just below the sutural conjunction of the neural arch. A narrow groove occupies

1870.]

the lower border of the body, as is indicated to be the case in the specimens. The posterior articular surface of the body is moderately pressed, but its lower fourth curves forward, producing a thick, convex for the accommodation of a chevron. The breadth of the articular surface scarcely four inches, and its depth is about the same measurement.

The species represented by the fossil may be named *POICILOPLEURON*. Should the division of the medullary cavity of the vertebral body into recesses by trabeculae be significant of other characters indicating the radosaurian to be distinct from *Poecilopleuron*, it might be named *DEMUS*.

2. A collection of fossils from the cretaceous formation of Pickens, Alabama, received from Dr. J. C. Nott, formerly of Mobile, indicates a sauroid reptile apparently of the genus *Clidastes*, of Prof. Cope. The remains consist of an anterior portion of one ramus of the lower jaw, a portion of the upper jaw, an axis and several dorsal vertebrae. The specimens are of intermediate size to *C. iguanarus* of the cretaceous of New Jersey, and *C. propython* of Uniontown, Alabama. It may be named *Clidastes intermedia*. The jaw fragments indicate more robust proportions than in *C. propython*. The fragment of the lower jaw is  $5\frac{1}{2}$  inches long and contains a series of nine teeth; the depth of the symphysis is one inch; the depth between the seventh tooth almost an inch and a quarter.

The body of a dorsal vertebra is almost an inch and a half long; the articular cup is a little over an inch wide and about three-fourths of an inch vertically. The neural arch retains the zygosphenoid and zygantrum, indicating the iguanian character of the extinct reptile.

Since communicating the above I have received for examination remains apparently of the same species, from the cretaceous formation of Kansas. Among them are two nearly entire dentary bones, the larger of which is about eleven inches. They contain the bases of the teeth, indicating the full series to be twelve. The more slender jaws of *C. propython* contain the dentary bones about the same length, contain a series of about eleven teeth.

3. The caudal vertebra represented in figures 15, 16, plate II, of the "Cretaceous Reptiles of the United States," indicates a reptile apparently of the genus *Leiodon* or *Macronaurus*. The constitution of the vertebra is that of the caudals of the known species of this genus. It probably belongs to the species described by Prof. Cope under the name of *M. proriger*.

4. The fine specimen of a fossil turtle exhibited to the Academy was by Mr. O. C. Smith, of Amherst, Mass., through Prof. Hayden, for my examination.



than in *Dermatemys*, and extend in advance of the suture between the hyo- and hypo-sternal plates.

The name of *BAPTEMYS WYOMINGENSIS* is proposed for the turtle. When complete the carapace has measured about one foot and a half in length by one foot in breadth. The sternum has measured about one foot in length; the depth of its pedicles 4 inches, their breadth 3 inches; the length of the posterior extremity 4 inches, its breadth at base  $4\frac{1}{2}$  inches.

It is probable that the specimen, from the same locality, upon which was characterized the *Emys Wyomingensis* (Pr. A. N. S., 1869, 66,) belongs to the same animal.

5. Among a multitude of fragments of turtle shells obtained by Mr. J. Van A. Carter from the same formation and locality in which the preceding specimen was found, there are many apparently of the *Trionyx guttatus* (Pr. A. N. S., 1869, 66.) Some of the fragments pertain to an emydoid differing from the preceding, but they are too imperfect to ascertain the exact generic characters. In this species both the vertebral plates and scutes are proportionately much wider in relation with their breadth than in *Baptemys*. The scutes mentioned are deeply impressed, whereas in the latter their boundaries are scarcely traceable. The series of vertebral plates from the first to the eighth, inclusive, measure eight and a half inches. The fore part of the sternum is truncate as in *Dermatemys*, but not so much produced. For the species the name of *EMYS STEVENSONIANUS* is proposed, in honor of James Stevenson, the companion and able assistant of Prof. Hayden in his geological explorations of the west.

PROF. O. C. MARSH, of Yale College, exhibited a series of specimens of the remains of birds from the cretaceous and tertiary of the United States, which showed that this class was well represented during these periods, although no species have yet been described from these formations in this country, and none indeed from older rocks, since it now appears to be well established that the bird-like foot-prints in the Connecticut Valley were made by Dinosaurian reptiles. Among the species shown were the remains of at least five species of cretaceous birds, although but one, or possibly two, species have hitherto been described from strata of this age in Europe. The present cretaceous specimens were all found in the green sand of New Jersey, and with one exception in the middle marl bed. They are all mineralized, and in the same state of preservation as the bones of extinct reptiles found with them in these deposits, and hence are readily distinguished from the remains of recent birds which have occasionally been found near the surface in the marl excavations of New Jersey.

The most interesting of the specimens exhibited was the distal portion of a large and robust tibia, apparently of a swimming bird, about the size of a goose; it was found in the green sand at Birmingham, New Jersey, in the pits of the Pemberton Marl Company. For this new genus and species Prof. Marsh proposed the name *Laornis Edwardsianus*. Two species of small wading birds, which appear to have been allied to the Curlews, were also represented, each by the distal end of a tibia, and probably by some other less characteristic portions. The larger of these species, which was found in the green sand of the middle marl bed at Hornerstown, New Jersey, was named *Palæotringa littoralis*, the smaller species, which was called *Palæotringa vetus*, was founded on the specimen mentioned by Dr. Morton in his Synopsis of cretaceous fossils (p. 32), which has since, however, been generally regarded as a recent species. The specimen was found in the lowest marl bed at Arnetown, N. J., and is now in the collection of the Academy. Portions of the humeri of two small and closely allied species, apparently related to the Rail family, were part of the series shown. They were found deep in the green sand of the middle marl bed, near Hornerstown, N. J., in the pits of the Cream Ridge Marl Company. For the species thus represented the names *Telmatornis priscus* and *Telmatornis affinis* were proposed.

1870.]

The remains of several species of tertiary birds were also exhibited by Prof. Marsh. Among these was the lower extremity of a tibia, closely resembling that of some of the cranes. It was found in the miocene of the Niobrara River, by Dr. F. V. Hayden, and is interesting as the only representative of a fossil bird yet detected in the tertiary deposits west of the Mississippi. This specimen, which belongs to the Academy, indicated a new species, which was named *Grus Haydeni*. Another species of extinct birds was represented by portions of a humerus and ulna, also in the collection of the Academy. They were found many years since in the miocene of Maryland by Mr. T. A. Conrad. This species, which appears to be closely related to the Petrels, was named *Puffinus Conradi*. Several other interesting specimens of bird remains were shown, but most of them were not sufficiently characteristic to admit of determination. With the exceptions already mentioned, the fossils exhibited belonged to the museum of Yale College.

---

Jan. 18th.

The President, DR. RUSCHENBERGER, in the Chair.

Nineteen members present.


---

Jan. 25th.

The President, DR. RUSCHENBERGER, in the Chair.

Thirty members present.

MR. WHARTON said that the ore of the nickel mine at Gap, Lancaster Co., Pa., consists substantially of a sulphide of iron, in which a small part of the iron is replaced by nickel, copper and cobalt. This ore after washing is smelted in a high furnace, and yields a matter about seven times as rich as the ore in the valuable metals, that is, containing 10 to 15 per cent. of nickel and cobalt and about one-third that quantity of copper. In this matter there are found at rare intervals small lamellar crystalline bodies, having high metallic lustre and pliability. In order to give a clearer idea of the nature of this substance, or to discover perhaps something still more interesting, search was made during several years of the masses remaining in each furnace bottom



**ANTHROPOLOGY.**

J. AITKEN MEIGS,  
F. V. HAYDEN,  
HENRY S. SCHELL.

**COMPARATIVE ANATOMY.**

HARRISON ALLEN,  
J. H. MCQUILLAN,  
JOS. LEIDY.

**MAMMALOLOGY.**

HARRISON ALLEN,  
E. D. COPE,  
H. M. BELLOWS.

**ORNITHOLOGY.**

B. HOOPEs,  
W. P. TURNBULL,  
E. SHEPPARD.

**HERPETOLOGY.**

E. D. COPE,  
HARRISON ALLEN,  
S. B. HOWELL.

**ICHTHYOLOGY.**

E. D. COPE,  
THADDEUS NORRIS,  
J. H. REDFIELD.

**ARTICULATA.**

G. H. HORN,  
R. S. KENDERDINE,  
H. M. BELLOWS.

**RADIATA.**

G. H. HORN,  
J. G. HUNT,  
R. S. KENDERDINE.

**BOTANY.**

E. DURAND,  
THOS. MEEHAN,  
ISAAC BURK.

**VERTEBRATE PALÆONTOLOGY.**

JOS. LEIDY,  
E. D. COPE,  
HARRISON ALLEN.

**INVERTEBRATE PALÆONTOLOGY.**

T. A. CONRAD,  
W. M. GABB,  
H. C. WOOD, JR.

**MINERALOGY.**

WM. S. VAUX,  
E. GOLDSCHMIDT,  
JOS. WILLCOX.

**STRATIGRAPHIC GEOLOGY.**

J. P. LESLEY,  
B. S. LYMAN,  
F. V. HAYDEN.

**PHYSICS.**

R. E. ROGERS,  
J. F. FRAZER,  
J. WARNER.

**CHEMISTRY.**

F. A. GENTH,  
R. BRIDGES,  
E. GOLDSCHMIDT.

**INSTRUCTION AND LECTURES.**

R. S. KENDERDINE,  
WM. MAYBURY,  
H. M. BELLOWS.

**LIBRARY.**

JOS. LEIDY,  
W. P. TURNBULL,  
ROBT. BRIDGES.

Dr. Chas. T. Hunter was elected a member.

*Feb. 1st.*

The President, DR. RUSCHENBERGER, in the Chair.

Twenty-five members present.

The following paper was presented for publication :

[1870.]

"Note on the relations of *Synocladia*, King (1849) to the proposed genus of *Septopora*, Prout (1858)." By F. B. Meek and A. H. Worthen.

The death of Mrs. E. H. Vaux was announced.

---

*Feb. 8th.*

The President, DR. RUSCHENBERGER, in the Chair.

The death of Caleb S. Hallowell was announced.

Notice was given of the publication of the third number of the Proceedings for 1869.

---

*Feb. 15th.*

DR. BRIDGES in the Chair.

Eight members present.

---

*Feb. 22d.*

The President, DR. RUSCHENBERGER, in the Chair.

Eighteen members present.

The following gentlemen were elected Members:

Chas. D. Reed, Jas. S. Martin and Theo. Harrison.

---

*March 1st.*

The President, DR. RUSCHENBERGER, in the Chair.

The following paper was presented for publication:

"Descriptions of new species and genera of Fossils from the Palaeozoic Rocks of the Western States." By F. B. Meek and A. H. Worthen.

If the hollow interior be the natural condition of the *Myiodon*-like humerus under inspection, it would not belong to *Myiodon robustus*. Independently of the cavity indicated, the bone is sufficiently different in size and form to indicate a different species from the *Myiodon Harlani* of North America. The humerus from Oregon, described by Perkins (Am. Jour. Sci. 1841, xlii, 136), and referred to the latter by Prof. Owen, is not only much larger, but it is of greater breadth in relation with its antero-posterior diameter. The fragment of a humerus from Big-Bone-Lick, Ky., represented in fig. 3, plate xiv of my "Memoir on the Extinct Sloth Tribe," is somewhat smaller than the corresponding part of the Oregon specimen, and is more compressed or wider in comparison with the antero-posterior diameter.

Prof. Leidy further observed that there appeared to be a point of some significance in the anatomy of the mandible of *Dromatherium silvestre* worthy of attention, though the appearance may turn out to be a deceptive one. Prof. Emmons had discovered three isolated rami of mandibles of this most ancient of American mammals in the triassic coal of North Carolina. Of the specimens, one is represented in fig. 66 of Emmons' American Geology, repeated in outline in fig. 650 of Dana's Geology. Another specimen Prof. Emmons presented to the Academy, and is contained in our museum. The point of interest to which reference is made is the apparent absence of a condyle. This process may have been lost, but in the two specimens seen by Prof. L.—that figured by Prof. Emmons, and that preserved in our museum—a separation of the process is not obvious.

---

March 8th.

DR. CARSON, Vice-President, in the Chair.

Twenty-five members present.

PROF. LEIDY made the following remarks:—The reptilian remains from the cretaceous formation near Fort Wallace, Kansas, presented to the Academy by Dr. T. H. Turner, and described by Prof. Cope under the name of *Elasmosaurus puyurus*, belong to an Enaliosaurian, as originally suggested by Prof. Cope. The anatomical characters of the different regions of the vertebral column, those of the shoulder and pelvic girdles, and of the preserved portions of the skull and teeth, are decidedly Plesiosaurian.

Prof. Cope has described the skeleton in a reversed position to the true one, and in that view has represented it in a restored condition in fig. 1, pl. ii. of his "Synopsis of the Extinct Batrachia and Reptilia," Pt. I, August, 1869, published in advance for the fourteenth volume of the Transactions of the American Philosophical Society. To explain the apparently anomalous and reversed arrangement of the articular processes (zygapophyses) of the vertebrae, he has supposed that those as ordinarily existing are substituted by the second set of articular processes (zygophene and zygantrum), as found in serpents and iguanians (Proc. Bost. Nat. Hist. Soc. xii, 265; Syn. Ext. Bat. and Rept. 42).

The finding of a portion of the jaws, as reported by Dr. Turner, in the vicinity of what Prof. Cope has supposed to be the cervical portion of the skeleton, and which he considers as confirmatory of the view he has taken of its position, without further consideration, is more than compensated in the opposite end of the column terminating in a coossified axis and atlas, as is the case also in the mature *Plesiosaurus*. The cup of the atlas still retains the hemispherical occipital condyle.

The Kansas saurian was wonderful for the length of its neck, far exceeding in this respect the *Plesiosaurus*. The vertebrae in the specimen form a nearly unbroken series to the seventy sixth inclusive. If we regard all as cervical until the transverse processes begin to spring in part from the spinal arch, it

1870.]

will comprise the extraordinary number of seventy-two. In the different species of *Plesiosaurus*, so far as known, the number ranges from twenty-four to forty-one. The length of the neck, independent of the head, was about twenty-two feet.

The cervical vertebrae successively increase in length to about the forty-fourth, then remain nearly the same to the sixtieth, and afterwards gradually decrease. The atlas-axis is about  $2\frac{1}{2}$  inches long; the third cervical is  $1\frac{1}{4}$  inches; the tenth nearly 2 inches; the twentieth  $2\frac{3}{4}$  inches; the thirtieth  $3\frac{1}{2}$  inches; the fortieth 4 inches; the forty-fourth  $4\frac{1}{2}$  inches, and so to the sixtieth; and the sixty-eighth to the last one about  $3\frac{1}{2}$  inches, which is also about the length of the succeeding four dorsals.

The imperfections in the remainder of the vertebral column of the Kansas saurian do not permit a positive estimate to be made of the comparative extent of the trunk and tail.

A comparison of the caudal vertebrae with isolated specimens from the cretaceous formations of Alabama, Mississippi and New Jersey, leaves but little doubt that *Elasmosaurus* is identical with *Discosaurus*. Such also appears originally to have been the opinion held by Prof. Cope in regard to a portion of the same skeleton, which he referred to a species with the name of *Discosaurus carinatus* (LeConte's Notes on the Geology of the Survey of the Union Pacific Railroad, 1868, p. 68).

Specimens of vertebral bodies from the New Jersey green sand, referred to *Cimoliasaurus* (Cret. Rept. of the United States, pls. v, vi), and supposed by me to belong to the posterior part of the column, are seen by comparison with the Kansas skeleton to be cervical and perhaps anterior dorsals. The difference in the proportions of the corresponding vertebrae appear to indicate the genus to be distinct from *Discosaurus*.

The imperfect vertebral specimens from Arkansas, originally referred to *Brimosaurus* (Pr. Acad. Nat. Sci. 1854, 72, pl. ii, figs. 1—3), are probably posterior cervicals of *Discosaurus*.

In the true view of *Discosaurus* and its allies, the so-called order of *Streptosauria* (Proc. Bost. Nat. Hist. Soc. 1869, 265; Synopsis Ext. Batr. and Rept., 40) fails to maintain its position.

The extensive shoulder and pelvic girdles of the Kansas saurian, so much like those of *Plesiosaurus*, were most probably provided with limbs constructed like those of the latter animal.

In its restored condition *Discosaurus* would appear to have resembled *Plesiosaurus* in its form as ordinarily represented, excepting that it possessed a much

Of several mental foramina, the largest one is situated below the position of the first premolar.

The condyle holds the same relative height as in Cats. The back portion of the jaw, including the coronoid process, is proportionately not so broad as in the latter. The masseteric fossa is shallower at its lower part, and is not bounded by the everted base, but is defined a little above the latter in a curvature sweeping from the condyle downward and forward to an angle about half-way below the position of the last molar tooth.

The molar teeth, of which there were five, completely occupied the space back of the canine, as in some of the viverrine and musteline animals, there being no hiatus in the series. All the molars were double-fanged, and none appear to have been of the tubercular kind.

The first premolar was the smallest, and the third premolar appears to have been the largest tooth of the molar series. The fourth premolar was intermediate in size to the third and the last molar, which appears to have but little exceeded this and the second premolar.

The remains of the crown of the last molar indicate a bilobed tooth, apparently like the sectorial molar of *Felis*, and without a heel. The crown of the tooth in advance was provided with a well-developed heel, but the fore part is too much broken to ascertain its form. The larger tooth in advance, the third premolar, retains its heel, which has a subtrenchant fore and aft border, and is bounded internally and externally by an oblique basal ridge.

For the animal indicated by the fossil jaw, the name of *Patriofelis ulta* is proposed. The measurements of the specimen are as follow:

Estimated length of lower jaw when complete .....	6 inches.
Breadth of coronoid process at base.....	1½ "
Height at condyle, and below last molar tooth.....	1½ "
Height below first premolar.....	1½ "
Length of molar series.....	3 "

Breadth of crown of first molar tooth, 4½ lines; second do., 8 lines; third do., 9 lines; fourth do., 7½ lines; fifth do., 8 lines.

Prof. Marsh exhibited specimens of the remains of a bird allied to the Turkey, which he considered as belonging to an extinct species. These remains were said to have been found in the green sand of Monmouth Co., N. J., but doubtless were from the post-tertiary above it. He proposed to name the species *Meleagris altus*.

Prof. Marsh also called attention to the tooth of a Peccary from the miocene of Shark River, New Jersey. It is a second molar from the left side of the lower jaw. He proposes to call the species to which it belonged *Dicotyles antiquus*.

#### March 15th.

The President, DR. RUSCHENBERGER, in the Chair.

Twenty members present.

The following paper was presented for publication:

"Cross Fertilization and Law of Sex in Euphorbia." By Thomas Meehan.

#### March 22d.

DR. CARSON, Vice-President, in the Chair.

Thirty-six members present.

The following paper was presented for publication:

1870.]

"Descriptions of Fossils collected during the U. S. Geol. Survey under the charge of Clarence King." By F. B. Meek.

PROF. LEIDY exhibited specimens of *ichthyodorulites*, upon which he made the following remarks:

**XIPHACTINUS AUDAX.** The genus and species are founded on an interesting specimen belonging to the collection of the Smithsonian Institution, and obtained from the cretaceous formation of Kansas by Dr. Sternberg. From the want of symmetry in the base of the specimen, I suppose it to have been the pectoral spine of some huge siluroid fish.

It is a broad sabre-shaped weapon, in its present condition sixteen inches long, which is near its original length, if one may judge from the thinness and rounding of the border at the broken end. At its middle it is nearly two inches broad and almost seven and a half lines thick. It slightly narrows and becomes thinner towards the outer end, and becomes thicker and more narrow approaching the base. An inch and a half from the latter it is thirteen and a half lines thick and seventeen lines wide; and the same distance from the outer end it is the fourth of an inch thick and twenty lines wide. The anterior convex border is rounded at first, but becomes subacute at its outer part. The posterior concave border is rather more obtuse.

A large groove commences back of the root, extending outwardly, becoming contracted and deeper, and opening to its bottom along the under part of the spine to its outer extremity. The bottom of the groove is irregularly pitted, and its upper surface formed by the overhanging posterior portion of the spine is transversely corrugated or striated. A similar but shallower groove commences in front of the root, and extending outwardly opens beneath the spine at the anterior half of its surface.

The upper surface of the spine is nearly flat and longitudinally striated, except at the outer part of the anterior border, where the striation is finer and curves forward.

The root of the spine turns up into a sort of hook-like process, broken at the end. It has been about two and a half inches in height from a level with the inferior surface of the spine. The inner part of the root forms a vertical oblong convexity, the lower half of which is occupied by a raised facet, apparently an articular surface, upon which the spine moved.

Prof. Agassiz, in his *Poissons Fossiles*, has described specimens of *ichthyodorulites* from the chalk of Lewes, England, which he referred to placoid fishes of the genus *Pylæodus* from *pyloides*, and they are of the same

quarter inches long and three-quarters of an inch wide, gradually tapering to seven lines, and is provided with about seven and a half dentate processes. The other fragment is three and three-quarter inches long, seven lines wide below, and four lines at the broken apex, and is provided with nine dentate processes.

The segmented condition of the ray recalls to mind a singular fossil specimen formerly described by me as the portion of a jaw of a fish to which the name of *Edestus vorax* (Jour. Acad. Nat. Sci. iii, 159, pl. 15) was given, and which also exhibits a segmented condition. This fossil, notwithstanding its jaw-like appearance furnished with shark-like teeth, I have always suspected was an ichthyodorulite (Proc. 1856, 301), and this suspicion is increased by an examination of the rays supposed to pertain to *Ptychodus*.

**ASTERACANTHUS SIDERIUS.** The species is founded on a fragment of an ichthyodorulite, found on a stream near Glasgow, Tennessee. The specimen was submitted to my examination by Prof. J. M. Safford, through Prof. Hayden. It purports to be of subcarboniferous age, but perhaps this is an error, for all the previous known fossils attributed to the genus are of much later age. It looks as if in its complete condition it had approximated in size the dorsal spine of *Asteracanthus ornatissimus*, which is a foot and a half long. The fragment is from an intermediate position at the junction of the root and shaft, and is a little over three inches in length. Broken at the extremities, and posteriorly, so as to leave no remains of a groove, it is composed of solid porous bone, and is triangular in transverse section. The triangle of the shaft has a base seven lines thick; the sides are about three-fourths of an inch wide, and the apex is rounded. The root is compressed laterally to a greater degree than the bottom of the shaft, and in the fragment is an inch and a half wide.

The lateral surfaces of the shaft are closely covered with large mammillary tubercles, which have been worn off at the summits. These tubercles are of enamel-like hardness, brown and lustrous. Their sides are closely and longitudinally wrinkled; the fewer wrinkles near the apex becoming branched and more numerous approaching the base. The tubercles are situated in parallel longitudinal rows, having a slight obliquity. The intervals formed by the divergence of the longer rows near the root are occupied by shorter rows. About thirteen rows, including the short ones, may be counted on one side of the specimen at the verge of the root.

PROF. LEIDY further observed that the two fossils presented this evening by Henry Green, of Elizabeth, Jo Daviess Co., Illinois, through Dr. Edward D. Kittoe, of Galena, were of considerable interest. They consist of a metacarpal bone of the Giant Sloth of Jefferson (*Megalonyx Jeffersoni*), and a last lower grinder of the extinct Ox, *Bison antiquus*. They were discovered, in the search for lead, in a narrow crevice of the lead-bearing rocks, at the depth of 130 feet, in the vicinity of Galena. A number of other bones were found at the same time, but, unfortunately for the interests of science, these are scattered or lost.

The museum of the Academy contains fossils which were found in a similar position in the same locality some years back. Of these, some were presented by Dr. LeConte, who obtained them from Mr. Snyder of Galena; others were presented by my friend Dr. Kittoe. They consist of remains of an extinct Peccary, *Platygonus compressus*, larger than the existing species; an extinct Raccoon, *Procyon priscus*, and a large insectivore, named in honor of Mr. Snyder, *Anomodon Snyderi*. These animals were probably cotemporaries of the former.

MR. THOMAS MEEHAN said that no one who examined the prevailing theories concerning the formation of bark and wood with numerous living specimens before him, could be satisfied that these theories were in all respects correct. He had made numerous observations during the past year, which satisfied him that at any rate we had much to learn. He hoped to present these observa-  
1870.]

tions to the members at some future time, but at present wished only to direct their attention to a portion of a trunk of *Yucca elaeagnifolia*, which he exhibited, the structure of which he suggested could not be accounted for on any theory generally known. The general idea was that the sap of plants ascended through the system, and was *elaborated* in the leaves, where the woody matter was formed, and afterwards *descended*,—in exogenous plants forming a regular concentric layer over the last year's wood, and in endogenous structures returning by the interior, pushing these descending columns of wood through the mass of cellular matter without order or system.

It would be seen that in this endogenous *Yucca* the woody matter, if it ever *descended* at all, as our present belief demanded it should do, had descended in a very regular and beautiful manner, quite as systematic, in fact, as most exogens would do. The wood was arranged in annual rings, not entirely concentric; but some tropical exogens did not have the woody annual layers always forming an entire circle any more than in this. In this case the annual layers of wood extended about two-thirds of the distance round the axis, and such layer was about the eighth of an inch thick. These annual layers were made visible by the bundles of fibres being packed more closely together towards the end of the season's growth, just as they are in exogens, from which, indeed, there was very little to distinguish this structure on a cursory examination but the absence of the so-called medullary rays.

---

March 29th.

The President, DR. RUSCHENBERGER, in the Chair.

Thirty members present.

A resolution to amend Art. XI, Chapter 10 of the By-Laws by the omission of the word "gratuitous," was adopted after a third reading.

The following gentlemen were elected members:

Geo. Hewston, W. H. Eisenbrey and Alfred Tucker.

On favorable report of the committees the following papers were ordered to be published:

Cross fertilization and the law of sex in *EUPHORBIA*.

BY THOMAS MEEHAN

ids have a pistil in the center, and others are wholly staminate, is, that there is *greater axial vigor when the female flower is formed*. Whenever the common peduncle (below the scarlet involucre) is weak, a pistil never appears at that head of flowers. A few which seem strong neither have them, but a great majority of the strong peduncles are those which bear the female blossoms. Another interesting fact is that the number of male flowers is less in those heads which also bear a female, than in those which are wholly staminate. This seems to add to the point I made in my paper on *Ambrosia*, that after the flowers have been partially formed in embryo, and before the sex has been finally determined, the female flower, being primordially the stronger, has the power of absorbing the males or their partially formed elements into its system. It is certainly remarkable that in both these instances the number of male flowers should decrease in proportion to the existence or power of the central female one.

The male and female flowers of *Euphorbia fulgens* are formed much alike. The female occupies the center, and seems really but a prolongation of the main stem, on the top of which is an articulation from which the ovarium springs. The capsula readily falls from this articulation when mature. From the base of the female central peduncle spring weaker peduncles, colorless, appearing indeed almost like filaments, articulated at about the same height as the female, only above the point bearing a short filament and anther—the staminate part before referred to. No one can fail to see the correspondence of plan in these different parts, and I think that nothing but the favorable position in the direct line of axial vigor made the central flower a female one.

Cases occasionally occur in which a tolerably strong head of wholly male flowers will develop the central axis into a pedicel *almost as long and vigorous as those which bear female flowers*. But the flow of vital force—if I am correct in using this term—not being quite sufficient, the final goal of natural perfection in the female form was not reached. These cases do not occur often, but are well worth looking for, as they show so clearly the dividing line between the forces which govern the male or female sex.

#### Note on the Relations of *SYNOCLADIA*, King, 1849, to the Proposed Genus *SEPTOPORA*, Prout, 1858.\*

BY F. B. MEEK AND A. H. WORTHEN,

Of the Illinois State Geological Survey.

Not having studied the *Polyzoa* of our rocks, it was only recently that we noticed the remarkable agreement between the fossil from the Chester division of the Lower Carboniferous, on which Dr. Prout proposed to found a genus *Septopora*, and the common Western Coal-measure species, that has been by some referred to the European Permian species, *Synocladia virgulacea*, the type of Prof. King's genus *Synocladia*. In identifying this fossil, from beds in Kansas referred by him to the lower Permian, with *S. virgulacea*, Prof. Swallow noticed that it differs from the foreign species in having only two, or, on some parts, apparently three,† rows of cellules to each of the longitudinal branches, instead of from three to five rows, as in the latter; and although he referred the Western species doubtfully to *S. virgulacea*, he proposed for it the provisional name, *S. biserialis*, in case the differences noted should be considered of specific importance.‡ Prof. Geinitz, however, did not consider these differences of full specific value, and referred the species to *S. virgulacea*.§

\* Transac. Acad. Sci. St. Louis, Vol. I, p. 448, pl. 18, fig. 2, 2 a, b, c, 1858.

† It is only immediately below the bifurcations of the larger stems that the pores are so arranged that they might be counted so as to appear to make three rows, the proper number of rows being only two.

‡ Trans. Acad. St. Louis, Vol. I, p. 179, 1858.

§ Carbonal and Dyas, in Nebraska, p. 70, 1866.

After a careful comparison of a series of good specimens, showing clearly both sides, of the fossil on which Dr. Prout proposed to found his genus *Septopora* (*S. Cestriensis*, Prout), from the original locality in the Chester limestone of the Lower Carboniferous, with an equally well preserved series of the Coal-measure fossil mentioned above, that has been referred to *S. virgulacea*, we find that they not only agree exactly in all generic characters, but that we have, up to this time, been entirely unable to discover any specific differences. We observe, it is true, among the Coal-measure specimens, some differences in the greater or less size, and irregularity of divergence of the branches, and consequent differences in the sizes and forms of the fenestrules; but the same differences are also observable among the specimens from the Chester beds, so that if we were to regard these as specific differences, we would have to admit several species to be common to the two horizons, instead of only one.

We have for a long time been aware of the fact that the form that has been referred to *S. virgulacea*, from the Kansas and Nebraska rocks, not only ranges through the beds included by some as lower Permian in Kansas, but that it has an extensive vertical and geographical range in the admitted Coal-measures of these States and Iowa. We are also now prepared to show that it not only ranges through the whole of the Coal-measures of Illinois, but that, as above stated, specimens beyond all doubt belonging to the same genus, and, as we believe, to the very same species, occur both in the St. Louis and Chester beds of the Lower Carboniferous limestone series. We were slow to adopt the conclusion that the specimens from these different horizons are really specifically identical, because we have so often, in such cases, on examining better collections than those first obtained, succeeded in finding differences not previously supposed to exist. In this instance, however, as well as occasionally in others, we have, as already mentioned, found the specimens to agree exactly in apparently all of their specific characters.

In regard to the generic relations of this fossil to the genus *Synocladia*, as typified by the common European Permian true *S. virgulacea*, there may be differences of opinion between some of those who draw very exact distinctions between genera, and others who give them greater latitude. That they really belong to the same genus, however, we can scarcely entertain any doubts, though it must be admitted that they are certainly distinguished on very nearly the same kind and degree of differences that distinguish *Fenestella* from *Polypora*.

It is a little remarkable that Dr. Prout, who made an especial study of the palæozoic *Polysoa*, should have failed to notice the very close relations between his *Septopora* and *Synocladia* at the same time that he assigned to the

will also be observed that he does not mention the *number* of rows of cellules or pores in each radial branch or stem, in his *generic* description, though he does so in describing the *species*; from which it is evident that he did not regard that as a generic character, and that he would have considered the American type as belonging to another species of the same genus.

For comparison with the above, we give below Dr. Prout's description of his proposed genus *Septopora*, from the Transactions of the Acad. Sci. of St. Louis, vol. I. p. 448:—

"Bryozoum a fan-like expansion, with longitudinal ribs [stems of Prof. King], irregular in size, radiating from a centre, branching and occasionally anastomosing, having two lines of pores, one on each side of a tuberculated midrib.\* Dissepiments forming arches or more or less angular, dividing the Bryozoum into quadrangular, round, semi-lunar, or rhombic fenestrules; each dissepiment supporting from one to four irregular lines of cell-pores; reverse smooth when worn, but more or less tubercled when perfect."†

He adds that, "though in its general features it resembles *Fenestella*, it differs in a marked degree by its celluliferous dissepiments." This, it will be observed, together with the *arched, or unguled character of its dissepiments, and the fact that they sometimes give origin to intermediate branches, or stems*, as Prof. King terms them, were exactly the characters mentioned by the latter author as distinguishing *Synocladia* from other allied *Fenestellidæ*. Although Dr. Prout does not mention the character of the angulated dissepiments giving off intermediate branches, his figure 2 a, pl. 18, of the St. Louis transactions cited, distinctly shows it, and it is even more strongly defined in specimens now before us, from the original locality, and identified by Dr. Prout himself. It is also worthy of note, that Dr. Prout's enlarged figures, 2 b and 2 c, of the plate above cited, do not give a correct idea of this fossil, as may be seen by comparison with his own description. Figure 2 c, for instance, represents the fenestrules proportionally much too small, and the dissepiments too thick and not in the slightest degree "forming arches, or more or less angular." Figure 2 b also fails to show this arching or bending upward of the dissepiments, and the "tubercles" or vesicles on the midrib, which characters are as strongly defined in the Chester and Coal-measure specimens as in Prof. King's figures of the typical *S. virgulacea*. Some portions of the celluliferous surface near the base of the frond might be selected from some specimens that would nearly agree with these figures given by Dr. Prout, but this is far from the general character of the fossil farther up, where the branches are more diverging, so as to form larger fenestrules.

The question respecting the relations of these Western specimens, from the several horizons mentioned, to each other, and to the European Permian *Synocladia virgulacea*, is, for other reasons, one of more interest and importance than the mere difference or identity of particular fossils, since it involves the question of the duration in time, and the consequent geological range, of one of the most important of the types that have been appealed to as evidence that the Permian should be carried down in Kansas and Nebraska, so as to include several hundred feet of rocks regarded by us and others as belonging to the true Coal-measures. Whether we regard this fossil as being specifically identical with *Synocladia virgulacea* (which we do not admit), or view it as a distinct species of the same genus, it is now evident that it can no longer be regarded as properly a *Permian* type; for, even if it could be shown to be only a *variety* of *S. virgulacea*, it would still be a *form* unknown in the Permian of Europe; while here it is, as above shown, not only one of our most abundant Coal-measure types, but one that began its existence during the deposition of lower Carboniferous or Mountain limestone series.

\* The midrib mentioned here is the "dividing ridge" of Prof. King, and the "tubercles" on it are the "(?gemmuliferous vesicles" of Prof. King.

† It is minutely striated in perfect specimens, as we know from examination of typical examples from the original locality.

It is worthy of note in this connection, that there are various other fossils in the upper members of our lower Carboniferous series that might with quite as much propriety be referred to European Permian species as many of the Western Coal-measure types that have been so referred. For instance, Dr. Proat long since (Trans. St. Louis Acad. Sciences, vol. I p. 450) identified *Polypora*, from the Chester beds, with the Russian Permian *P. biarmica*, while several other species of *Polyzoon* found in the Chester group are scarcely distinguishable from forms found in western beds that have been by some included in the Permian. We also now know that there are species of *Schuchertella*, *Pleurophorus*, etc., in the Chester beds very like Permian forms, while a Crinoid found by Prof. Marcou in beds in Nebraska (referred by him to the Permian) and thought by him to be "extremely near *Encrinurus moniliformis* M. G. of the Muschelkalk of Europe," is now known to range through the whole of the Western Coal-measures, and to be represented in the Chester limestone beneath the Millstone-grit by closely allied species. Indeed, a number of Crinoids that have been recently discovered in the Chester beds and the Coal-measures of Illinois are remarkably similar representative forms. Even the curious *Zuercheria microspina* of McClesney, from the Upper Coal-measures of Illinois, has its nearly allied representative in the Chester limestone beneath the Millstone-grit.

Numerous facts like the foregoing (such, for instance, as the occurrence of Tertiary types of plants in the Nebraska Cretaceous), might be cited to show that in many instances particular forms of life, both animal and vegetable, appeared here at earlier periods than in the old world. Hence, great care and some general knowledge of the entire fauna and flora of our rocks are often required in order to arrive at sound conclusion with regard to their relations to particular horizons of the series, as made out in Europe.

April 5th.

DR. CARSON, Vice-President, in the Chair.

Twenty-three members present.

PROFESSOR LEIDY made the following remarks on *DISCOBATEA* AND ITS ALLIES.

The body of the last vertebra in the series of caudals belonging to the *Kanabosaurus*, described by Prof. Cope under the name of *Elasmosaurus*, has the length less than the depth or breadth, which latter is the greatest diameter. It is moderately contracted towards the middle, the sides below the neural arch and the surface below the costal articulations being fore and aft concave and bounded in front and behind by an acute margin from the articular ends. A ridge extends fore and aft between the chevron articulations and the included surface is concave, and exhibits a single lateral venous foramen. The costal articular processes project from the middle of the side of the body reaching nearer the fore than the back end of the latter. They are transversely oval, about three-fourths the length of the body, and the height about half. They form a deep concavity, with acute margins expanding peripherally. The articular ends of the body are transversely oval and defined from the intermediate portion of the latter by an acute everted margin. A short distance within the position of the latter the surface is marked by a narrow groove, and within the circle of this groove the surface projects in such a manner as to appear like a distinct disk or epiphysal plate applied to and coöalescing with the body. The surface of the disk is convex at the periphery and moderately concave towards the centre. The articular surface beyond the groove defining the disk appears as an everted ledge, and the triangular articular facets for the chevrons appear as deflections of the ledge. The extension of the latter inferiorly is greater at the posterior extremity of the body than

[April

at the anterior extremity, thus producing a larger provision of surface in that position for the articulation of the chevron. The neural arch in the specimen has apparently been so much laterally compressed, that its original condition cannot be ascertained.

It was upon several similar isolated vertebræ to the one just described that the genus *Discosaurus* was established, and I shall now proceed to examine them comparatively with the object of determining their relationship with the Kansas saurian.

The genus *Discosaurus* was originally indicated from a mutilated body of a caudal vertebra from the cretaceous formation of Alabama (Proc. Acad. Nat. Sci. 1851, 326). In its imperfect condition, its peculiar character, and resemblance to a vertebra represented, by Prof. Owen, as a cervical of *Plesiosaurus pachyomus* (British Fossil Reptiles, pl. 28,) it was mistaken for a cervical. The specimen, together with another from the same individual, were described in their true position, as relates to the regions of the vertebral column, in the "Cretaceous Reptiles of the United States." They are represented in figs. 4, 5, 6, pl. v, of that work. The two vertebral bodies bear a near resemblance with that of the Kansas saurian above described. They have nearly the same proportions, and are slightly smaller and rather less contracted intermediately. The interchevron ridges are comparatively less well developed. The discoid arrangement of the articular ends is even more conspicuous. The disks are more prominent, more decidedly defined from the ledge beyond by a deeper constriction or groove. The periphery of the disks is rather more convex, and the surface towards the centre slightly less concave. The outside ledge is comparatively narrow and is not everted. The chevron articular surfaces appear rather to be produced through deflections of the groove defining the disk, than by an extension of the ledge, so that the chevrons would appear to have articulated with the depressed margin of the disk itself instead of with the ledge. The neural arch is broken away in both specimens, except part of an abutment in one of them.

The slight difference in size of these vertebræ from that of the Kansas saurian, as well as the feebler production of the interchevron ridges, might readily be due to their more posterior position in the column. The more decided constriction of the disks at the articular extremities from the rest of the body, which led to the application of the name of *Discosaurus*, might be regarded as an individual peculiarity, or a variation in specific character; which is often greater than real specific or even generic characters.

A similar vertebra, from the lower cretaceous of Mississippi, represented in figs. 10—12, pl. v of the "Cretaceous Reptiles of the United States," likewise referred to *Discosaurus*, has the same size and proportions as that above described of the Kansas saurian. In its anatomical characters it is intermediate to the latter, and those of the Alabama saurian. The interchevron ridges are intermediate in degree of development. The most marked difference exists at the articular ends of the body. The articular surface is comparatively flat, being but feebly depressed towards the centre and as feebly rounded towards the periphery, which extends to the acute margin defining it from the sides of the body, almost without the intervention of a groove such as is described in the preceding specimens. A slight deflection in the course of the acute border defines the anterior chevron articulation. The posterior chevron articulation is comparatively large and more distinctly defined than the corresponding one in the Kansas and Alabama specimens. The sides of the neural arch ascend in a steep slope from the more concave sides of the body, sweeping outwardly to the upper border of the costal pit. The diameter of the spinal canal is about seven lines.

Another vertebral body, from the cretaceous formation of New Jersey, referred to *Discosaurus*, is represented in figs. 7—9 of the work above indicated. It presents characters in common with the preceding specimens, but likewise has peculiarities of a decided kind. It approaches most the Alabama speci-  
1870.]

mens, and has nearly the same size. Interchevron ridges are entirely obsolete. The articular extremities of the body are very like those of the Alabama specimens, but the groove defining them from the acute margin is very inconspicuous or nearly obsolete. The deflections of the acute margin for the accommodation of chevrons are comparatively and remarkably deep, especially those anteriorly. The spinal canal at the orifices is about seven lines wide; at the middle scarcely five lines.

In all the specimens above indicated, a single venous foramen is situated on the under side of the body, to the right of the median line.

Comparative measurements of the specimens are as follow :

Caudal from	Kansas,	Mississippi,	Alabama,	New Jersey.
Length of body inferiorly.....	24½ L.	24½ L.	23½ L.	23½ L.
Breadth ant. artic. surface.....	36	36	33½	34
Depth " " " .....	30	30	26½	27½
Breadth post. " " .....	34	34	31	31½
Depth " " " .....	29	29	—	26
Breadth costal artic. cavity.....	18	17	15	15
Depth " " " .....	12	11	11	11
Width between inf. margins of costal cavities... ..	39	39	38	38
Distance fore and aft of chev- ron surfaces.....	16	16	16	12½

We thus have the nearly corresponding caudal vertebrae of four individuals, from the cretaceous formation of as many different localities, agreeing nearly in size, proportions, form, and construction, but exhibiting decided peculiarities in every case. Are these peculiarities to be considered of generic and specific value; of specific value alone; or are they to be regarded as variations in the characters of a single species? From the specimens alone I would incline to view them in the latter light, though I admit that each variation may represent a different genus, or a different species of the same genus. The reason for referring any one to a genus is equally good for all. If the Alabama specimens be regarded as characteristic of *Dicosaurus*, and the Kansas one of *Elasmosaurus*, the caudal from Mississippi, with its nearly flat ends, is quite as characteristic of a third genus, and the New Jersey caudal with its peculiarities, would form a fourth. The close correspondence in size of the specimens rather favors the view that they all pertain to the same species, though this may be as coincidental as the discovery of the nearly corresponding vertebra in the four cases. The one which, in my view, is most distinctive from the others, is the specimen from Mississippi, with the nearly

to bear a resemblance to those of *Cimoliasaurus*, and were referred to an animal with the name of *Brimosaurus grandis*. Through comparison with the skeleton of the Kansas saurian, they appear to be posterior cervicals, and further appear sufficiently near in character to belong to the same, though their larger size renders it probable that they pertained to a larger species.

A question arises as to the relationship of those remains originally referred to *Cimoliasaurus* with *Discosaurus* in the present state of our knowledge of the latter. In the first place, by comparison with the skeleton of the Kansas saurian, we observe that the position in the column, assigned to the vertebral bodies of *Cimoliasaurus*, was incorrect, and this probably contributed to mislead Prof. Cope in his examination of the skeleton of the Kansas saurian.

The vertebral specimens referred to *Cimoliasaurus* consisted of two sets of specimens, from two different individuals, both from the green sand of Burlington Co., N. J. They are described in "Cretaceous Reptiles," page 25, and characteristic ones represented in plates v. and vi.

The eleven vertebræ considered as lumbar, and represented by figs. 17-19, pl. v, and 16-18, pl. vi, are evidently cervicals. Those considered as dorsals on page 26, and represented in figs. 13-16, pl. v, are at least in part posterior cervicals. Of the fourteen vertebræ referred to on page 27 as dorsals and lumbar, those described and represented in figs. 1-5, pl. vi, are alone dorsals, while the others described and represented in figs. 6-9 are posterior, and those of figs. 10-18 more anterior cervicals.

The cervicals of *Cimoliasaurus* are so different in their proportions from those of the Kansas saurian that there can be no question as to the distinction of the two animals, at least as species.

Do all the remains originally referred to *Discosaurus* belong to this genus as distinct from *Cimoliasaurus*? I suspect that those from New Jersey belong to the latter. The animals indicated by all the fossils which have been under consideration are Plesiosauroid, and as in recognized species of *Plesiosaurus* there is much variability in the number, proportions, and other characters of the cervicals without a corresponding extent of variation in other parts of the vertebral column, we would be prepared to find in *Cimoliasaurus* nearly the same kind of caudals as in *Discosaurus*.

Prof. Cope, in his "Synopsis of the Ext. Batrachia and Reptilia," pt. i, 1869, p. 56, describes two vertebral specimens from the lower bed of the cretaceous green sand of Gloucester and Monmouth counties, which he attributes to a species with the name of *Elasmosaurus orientalis*. The specimens described as caudals are seen, by comparison with the Kansas skeleton, to be cervicals.

The smaller of the two specimens is intermediate in its form, proportions, and size with what appear to be the nearly corresponding vertebræ of the Kansas saurian, and the vertebræ referred to *Cimoliasaurus*. The larger specimen I have not seen, but from the description and measurements given it would appear to have belonged to a species quite as large as the Kansas saurian. The comparative measurements of the two specimens with that of the Kansas saurian, which appears to be most like them, and with the largest of the specimens which had been referred to *Cimoliasaurus*, are as follow:

	New Jersey specimens.		Kansas sp.	<i>Cimoliasaurus</i> .
Length of body.....	3½ in.	4½ in.	4½ in.	3 in. 11 l.
Breadth " .....	4½ in.	5½ in.	4½ in.	4 in. 2 l.
Depth " .....	3 in.	4½ in.	3½ in.	3½ in.

The various remains to which I have referred in this communication probably indicate a number of different species of a genus, presenting a like variability in the number and proportions of the cervicals as has been observed in the closely related genus *Plesiosaurus*. In the present condition of knowledge of the remains, they appear to me to be referable to a series of species as follow:

1. DISCOSAURUS VETUSTUS.

Leidy: Pr. Ac. Nat. Sc. 1851, 326; Cret. Rept. United States, 1865, 22, 1870.]

*Cimoliasaurus magnus*. Cope: Pr. Bost. Soc. Nat. Hist. 1869, 266.

*Cimoliasaurus vetustus*. Cope: Synopsis Ext. Batr. Rept., &c., 1869, 57.

Cretaceous of Alabama.

2. *DISCOSAURUS GRANDIS*.

*Brimosaurus grandis*. Leidy: Pr. Ac. Nat. Sc. 1854, 72, pl. i, figs. 1-3.

*Cimoliasaurus grandis*. Cope: Pr. Bost. Soc. Nat. Hist. 1869, 266; Synopsis Ext. Batrachia, Reptilia, &c. 1869, 57.

Cretaceous of Arkansas.

3. *DISCOSAURUS CARINATUS*.

*Elaemosaurus platyurus* and *Discosaurus carinatus*. Cope: LeConte's Notes on the Geology &c. Union Pacific Railway, 1868, 68.

*Elaemosaurus platyurus*. Cope: Pr. Ac. Nat. Sc. 1868, 92; Pr. Bost. Soc. Nat. Hist. 1869, 266; Synopsis Ext. Batr. Rept. 1869, 46.

Cretaceous of Kansas.

4. *DISCOSAURUS MAGNUS*.

*Cimoliasaurus magnus*. Leidy: Pr. Ac. Nat. Sc. 1851, 325; 1854, 72, pl. ii, figs. 4-6; Cret. Rept. U. S. 1865, 25, pl. v, figs. 13-19, pl. vi. Cope: Pr. Bost. Soc. Nat. Hist. 1869, 266; Synopsis Ext. Batr. Rept. 1869, 57.

*Discosaurus vetustus* in part? Leidy: Cret. Rept. U. S. 1865, 24, pl. v, figs. 1-3, 7-9.

Cretaceous of New Jersey.

5. *DISCOSAURUS PLANIOR*.

*Discosaurus vetustus* in part. Leidy: Cret. Rept. U. S. 1865, 23, pl. v, figs. 10-12.

Lower cretaceous of Mississippi.

6. *DISCOSAURUS ORIENTALIS*.

*Elaemosaurus orientalis*. Cope: Pr. Bost. Soc. Nat. Hist. 1869, 266; Synopsis Ext. Batr. Rept. 1869, 54.

Lower cretaceous of New Jersey.

In the cervicals of *Discosaurus*, so far as can be ascertained by the material at command, there appears to be no subdivision of the articular process for the riblets, as in *Plesiosaurus*. In the latter the chevron bones consist of lateral halves, ununited by osseous tissue. In the skeleton of the Kansas saurian, intervening between two of the caudals, there is a bone which looks as if it might be an inverted Y-shaped chevron, with one arm broken off. The spine between the caudals is also broken off. The remaining arm, broken

sions shallow, quadrangular, or transversely rhombic (those on the upper part being quadrangular, and those farther down becoming more rhombic, and wider than high), arranged in spirally ascending rows, which make nearly one turn in passing from the base to the centre of the top; each with a transverse linear central furrow, from which a similar furrow passes to the lower angle; central perforations of the cell depressions minute, and generally closed in the typical specimen.

Height, 1.75 inches; breadth, 1.22 inches.

This species differs from all others known to us, especially from any Upper Silurian horizon, in its elongated, obovate form, its outline being almost exactly obovate, excepting the truncation of the lower (smaller) end. In general appearance it perhaps most nearly agrees with a form found in the Galena Limestone, and referred by us, doubtfully, to *R. globularis*, Hall, in the third vol. Illinois Geol. Reports, pl. 2, fig. 2 a, b. It differs, however, from that species in having the upper end more round, or less depressed, and without any umbilicoid impression. Its cell impressions are also very different, not being near so crowded, and instead of becoming more crowded and narrower on the lower half, they are less so there than above; while the central perforation of each is much smaller.

*Locality and position.* Bridge Port, near Chicago, Illinois. Niagara Group of Upper Silurian.

We are under obligations to the Rev. E. C. Bolls, of Portland, Me., for the use of the only specimen of this species we have seen.

## ECHINODERMATA.

### BARYCRINUS SPECTABILIS, M. and W.

Body attaining a large size, rather deeply cup-shaped, though wider than high; truncated below, with sides moderately expanding upward. Base basin-shaped. Basal pieces rather large, nearly twice as wide as high, pentagonal in form, with the mesial angle above deeply impressed, the impression being also continued down the middle to the lower edge, with a broad prominence or ridge on each side of it also extending to the lower edge, where each of these prominences terminates in a little angular projection, while the lateral margins are strongly and abruptly beveled, so as to form deep, wide notches at the sutures. Subradial pieces large, hexagonal, excepting one on the anal side, which is heptagonal; all very profoundly impressed at the corners, so as to form strong, radiating ridges, extending one to each of the sides, to connect with those on the other contiguous plates; sometimes these ridges terminate in pinched-up nodes on the central region. First radial pieces about twice as wide as high, being generally a little wider than the subradials, pentagonal in form, with superior lateral angles more or less truncated, and slightly projecting at the edge, each with its broad, very shallow sinus above, for the reception of the second radials, more than three-fourths as wide as its upper margin, while the deep impression at the lower angles form two broad, very strong ridges, extending downward to connect with those on the subradials; sometimes these terminate near the middle above, in sharp pinched-up, diverging nodes, or short carinæ, while between these and the superior lateral, truncated angles, one or two other sharp prominences are sometimes seen. Second radial pieces extremely short, or almost transversely linear, and not always entirely filling the broad shallow sinuses in which they rest. Third radials triangular, a little higher in the middle than the first, but wedging to a very thin edge on each side, or even sometimes thinning out so as to let the first brachial pieces rest, at the lateral ends partly upon the first and partly on the second radials. Anal pieces of moderate size, quadrangular in form, a little wider than high, and resting on the upper truncated edge of the heptagonal subradial, while its own upper edge is truncated entirely across, nearly on a level with the superior lateral angles of the first radial on each side of it.

1870.]

Arms two from each ray, rather long, rounded, and tapering; very stout below, where they are composed of thin (short) wide pieces, the first two of which, in each pair of arms, are joined together at their inner ends; above these the arms of each ray diverge more or less from each other, and throw off alternately on each side stout armlets from every second piece. Arm pieces above the wide ones at the base, somewhat longer in proportion to breadth than the latter, and more or less wedge formed, with each a little pinched or angular ridge or projection on each side, ranging transversely to the arms. Armlets stout, about eight to nine on each side of each arm, near half as thick as the arms just above the points where the two connect; composed of pieces of nearly the same form as the arm pieces, but generally showing a slight disposition to become a little zigzag, and, at least some of them, throwing off alternately on each side a series of smaller secondary armlets, exactly as they are themselves given off from the main arms. Secondary armlets showing a slight zigzag appearance, from the greater thickness and prominence of every second piece on opposite sides, so as to appear as if they may give off a tertiary series of armlets, or pinnulae, though the specimen does not show these if they exist.

Column very stout, nearly round, and composed, at least for about three inches or more below the base, of alternately thin and somewhat thicker pieces, the latter of which project outward a little beyond the others, and show a slight disposition to become nodular, or irregularly thickened on the edge. Internal cavity large, with an obtusely pentagonal section. Longitudinal sutures, dividing the column into five sections, partly anchylosed, but still visible.

Height of body, about 1 inch; breadth, about 1.70 inches; length of arms, 3.80 inches; thickness of do. at the base, 0.40 inch; thickness of column near base, 0.60 inch.

This fine large species seems to be most nearly allied to *B. Thoma*, (= *Cyathocrinus Thoma*, Hall), from the Warsaw Limestone, but differs in having the impressions at the corners of its body plates, and the ridges between the same, greatly more strongly defined, and its arms much stouter, and more rounded below. Its column is also proportionally thicker, with a more obtusely pentagonal internal cavity. The typical specimens of the *B. Thoma*, which are now before us, are not in a condition to show much of the arms, but as far as they can be seen, they seem to be proportionally more slender, and we can scarcely doubt that they will show other corresponding differences in the details of their structure, when better specimens can be compared. We have ascertained, however, that the arm-pieces of the typical specimens of *B. Thoma* have on their sides little pinched-up prominences, as in the species



tracted above. Basal plates of moderate size, pentagonal in form, and spread out horizontally so as to form a nearly flat pentagonal disc, excepting that the salient angles are curved upward a little; facet for the attachment of the column small, compared with the size of the base, round and not impressed. Subradial plates large, forming the widest part of the body, convex on the outside, but not from thickening; about as wide as long, hexagonal, with perhaps the exception of one on the anal side of heptagonal form; all curving under below to connect with the base. First radials somewhat smaller than the subradials, wider than long, pentagonal in form, and provided above with very small, shallow sinuses for the reception of the second, which are small, but more than filling the shallow little sinuses. Third radials, in two of the arms seen, small, and bearing on each of their superior sloping sides, a long, very slender, subcarinated arm, which bifurcates on the second piece above; while the divergent divisions subdivide two or three times again above, at intervals of three or four pieces; the divisions and subdivisions all being very slender, and composed of joints about twice as long as wide. In two of the rays seen, however, the free arms are simple from their origin on the first radials, at least as far up as to the sixth piece, inclusive, (which is as far as they can be traced in the specimen), and present the remarkable character of having the second, third and fourth pieces greatly dilated, or alate on each side, so as to be nearly two-thirds as broad as the whole body below; though the first piece next the body (second radial), is narrow, and nearly twice as long as wide, as are the fifth and sixth pieces. Surface smooth, or only finely granular; sutures close fitting, or not channeled. Anal plate and column unknown.

Height of body, 0.20 inch; breadth of do., 0.34 inch; breadth of the dilated part of one of the simple arms, about 0.22 inch.

It is possible that the dilated arms may bifurcate above the sixth piece, though the specimen from which the description is made out is not in a condition to enable us to settle this point. The fact that they become suddenly narrow above the fourth piece, would seem to indicate that they may possibly assume the character of the other arms farther up. As seen lying partly imbedded in the matrix, with the long-jointed, slender arms and their branches incurved, above the little globular body, the whole reminds one very much of the Jurassic genus *Saccosoma*, Agassiz.

The very remarkable characters of the arms in this little crinoid, if not due to abnormal development, would certainly seem to warrant its separation, at least subgenerically, from the typical forms of *Cyathocrinites*. It also seems very improbable that its ventral disc is constructed as in the typical forms of that genus. Should other specimens show the peculiarities we have mentioned to be normal, we would propose for this type the generic or subgeneric name *Saccosomopsis*.

Specifically this form, at least so far as regards its body, seems to be exactly like a species described by Prof. Hall, under the name *Cyathocrinus parvibrachiatulus* (Jour. Bost. Soc. Nat. Hist., Vol. vii, p. 395, 1861); and it is worthy of note, that he describes its "subrachial" or free radial pieces as being "two to each ray, broad and strong, but varying in the different rays." As these pieces "vary in the different rays," may not those he saw, that were broad and strong, have belonged to dilated simple rays, as in our species, and these rays been broken off above the second pieces, in the specimen described? If so, his species would almost certainly belong to the same group as ours, but differs specifically in having its bifurcating arms shorter, more rapidly diminishing in size, with shorter pieces between the bifurcations, so as to bring the subdivisions closer together; also in having larger and deeper sinuses in its first radials for the reception of the second.

We are much inclined to believe there is a little group of species having essentially the form of body, and the peculiarities of the arms we have described, and that it will probably include *Cyathocrinites Saffordi*, the arms of which are unknown.

1870.]

*Locality and position.* Crawfordsville, Indiana. Keokuk division of the Lower Carboniferous series. The specimen from which our description was made out belongs to the collection of Mr. Corey.

*POTERIOCRINITES (ZEAOCRINUS?) CONCINNUS, M. and W.*

Body wider than high, rather rapidly expanding upward from the column. Base small, basin-shaped about three times as wide as high, and truncated about three-fourths its breadth below by the facet for the attachment of the column. Basal pieces wider than high, pentagonal in form, and expanding upward from the column, which is rather stout, round and composed nearly of the base of thin pieces. Subradials of moderate size, not thickened or truncated, four hexagonal, and one on the anal side leptagonal. First radials as wide as the subradials, but shorter, pentagonal, and truncated their entire breadth above. Second radials as wide as the first but scarcely more than half as long, all transversely oblong in form. Third radials in the posterior and anterior lateral rays, of nearly the same size and form as the first but truncate with the sloping sides above. On these sloping sides they each support two unequal arms, the posterior one of which in one of the posterior lateral rays is smaller than the other, and can be seen to bifurcate on the fourth piece, while the other bifurcates on the second piece and its subdivisions divide again at various distances above, several times, so as to make altogether about thirteen or more subdivisions in this ray. The anterior and division of one of the anterior lateral rays can also be seen to bifurcate on the fifth piece above the third radial, and one of its branches subdivides at different distances above into three subdivisions, and the other into four. Anterior ray simple to the eighth piece, the pieces between the first and last being short and somewhat wedge-form, while the last is pentagonal and supports two arms, each of which can be seen to bifurcate at least once some distance above. Anal pieces with the usual double alternating arrangement, the lowest piece being obliquely inserted between the upper sloping sides of two of the subradials, and partly under one side of one of the first radials, while a contiguous piece on the left above is supported on an upper truncated side of one of the subradials, and the latter are succeeded by others that connect with the base of the proboscis.

Arms long slender, very straight, and gradually tapering, slightly convex on the dorsal surface, and flattened so as to fit closely together on each side, with all their divisions running up parallel, or showing scarcely any divergence at the bifurcations, and all composed of short wedge-formed pieces, arm pieces not more protuberant than the others. Pinnulae small, and arising from the upper part of the longer side of each arm piece, alternately on each side, and rather closely approximated to each other.

Surface, in well preserved specimens, finely and obscurely granular, the granules showing on the arms (as seen under a magnifier) a tendency to arrange themselves in longitudinal rows, or to assume vermicular form. Sutures between all the pieces merely linear.

Entire length of arms and body, 2.80 inches; height of body to the top of first radials, 0.27 inch; breadth about 0.43 inch. Thickness of column, at connection with the base, 0.17 inch.

This species seems to combine, to some extent, the characters of *Poteriocrinites* and *Zeaocrinus*. In general habit, especially in the somewhat flattened and closely contiguous characters of all the divisions of its arms, as around when folded together, as well as, to some extent, in their mode of division, reminds one of many species of *Zeaocrinus*. In the form of its body, however, and particularly in having three primary radials, instead of only two in each of the anterior lateral and posterior lateral rays, and about eight below the first bifurcation in the anterior ray, as well as in the general form of its body, it agrees more nearly with the typical forms of *Poteriocrinites*. We know

[Ap

no species liable to be confounded with this when specimens can be seen with its arms well preserved.

*Locality and position.* Keokuk division of the Lower Carboniferous series, at Crawfordsville, Indiana. The typical specimen belongs to Mr. Corey, of Crawfordsville, to whom we are indebted for the loan of it.

SCAPHIOCRINUS DEPRESSUS, M. and W.

Body small, somewhat basin-shaped, about twice as wide as high to the top of the first radials, broadly truncated and concave below, with but slightly expanded or nearly vertical sides. Base occupying the concavity of the under side, and apparently flat or concave. First radial pieces about as high as wide, a little convex, rising vertically, except below, where they curve abruptly inwards to connect with the base; all seen, presenting pentagonal general outlines on their outer faces. First radial pieces nearly twice as wide as high, pentagonal in form, and truncated their entire breadth above for the reception of the second radials. Anal pieces unknown. Second radials larger than wide, strongly constricted in the middle with steeply sloping sides for the support of the arms above. Arms simple from their origin on the second radials, slender, and composed of long, rounded, somewhat constricted joints, which are obliquely truncated at the ends, with the upper end of all projecting, alternately on opposite sides for the support of long, very slender tentacles, composed of long joints.

Breadth of body, near 0.30 inch; height, 0.15 inch. Arms apparently about 1.12 inches in length, and only 0.05 inch in thickness at the constricted part of one of the lower joints; first four joints 0.32 in length.

In its depressed body, with nearly vertical sides, and broadly truncated, concave lower part, this species seems to resemble *S. unicus*, of Hall, as near as can be determined from a description alone. It differs, however, in having the arms simple from their origin on the second radials, with long instead of very short joints. It is peculiar in the broadly truncated and concave character of its under side, as well as in the slenderness of its arms and pinnulæ. The latter are also remarkably distant from each other, owing to the length of the arm joints.

*Locality and position.* Crawfordsville, Indiana. From the Keokuk division of the Lower Carboniferous series.

ZEACRINUS? ARMIGER.

Body small and depressed, or nearly basin-shaped, but with the under side rounded, and concave in the middle. Base very small and nearly or quite hidden in the concavity of the under side. Subradial pieces comparatively large and curving under below, but not tumid or convex; three with a general pentagonal outline, but probably having a sixth obtuse angle at the middle of each below; the other two, on the anal side, presenting a general hexagonal form, but truncated by the anal pieces in such a manner as to present a heptagonal form, exclusive of the very obtuse angle probably existing at the middle of the under side of each. First radial pieces twice as wide as high, pentagonal in form, and truncated across their entire breadth. Second radials as high as wide, each bearing two arms on their superior sloping sides, and developed into a long, slender, rounded, mucronate spine, which is directed nearly horizontally outward. Anal pieces small, and arranged in a double alternating series, the first on lowest piece being somewhat cuneiform and wedged obliquely down between one of the subradials and the under side of the first radial on the left, so as to touch, by a very short side, the next subradial on the left; second anal piece resting on the short truncated summit of one of the heptagonal subradials, and connecting on the right with one of the first radial pieces, and on the left with one of the upper sides of the first anal piece, and another piece resting on the latter. Above these,

1870.]

others continue on up to connect with the base of the ventral extension of the body. Arms unknown, surface smooth, sutures not impressed.

Breadth of body, 0.39 inch; height of same to top of first radials, 0.7 inch, length of spines formed by the extension of the second radials, 0.48 inch.

In the peculiarity of having its second radial pieces developed into one slender spine, this species agrees with *Zeacrinus* (?) *macrospinus* of McCroney, from the upper Coal-measures, and may be regarded as a representative form of that curious Coal-measure species, in the upper part of the Lower Carboniferous. It differs however, specifically from Prof. McCroney's species not only in being much smaller and more delicate but in having its subradial pieces much shorter in proportion to breadth and distinct crenate produced and pointed at the ends. Its anal pieces are also very differently arranged, the first or lower one being wedged down obliquely under the first radial on the *left*, instead of under that on the *right* of the anal series as in *Z. macrospinus*. It is the first American species of the *Cyathocrinus* we have ever seen with this reversed arrangement of the anal series, though Prof. McCoy has represented a similar arrangement of these parts in an analogous form from the Carboniferous rocks of Scotland. Until the arms of this crinoid can be seen it is not possible to determine whether or not it belongs properly to the genus *Zeacrinus*.

*Locality and position.* Pope County, Illinois. Chester division of the Lower Carboniferous.

*ZEACRINUS* (*HYDBRIONOCRINUS*?) *ACANTHOPHORUS*, M. and W.

Body below the top of the first radial pieces much depressed or nearly saucer-shaped, but concave below. Base very small and almost entirely hidden in the concavity of the under-side when the column is attached. Subradial pieces small, four of them included in the concavity of the under side and projecting horizontally outward into rather acute angles between the first radials so as to present a subtriangular general outline, though they are really hexagonal, their lateral and inner edges being connected with each other and to the base, so as to form four very short sides with five of secure angles. Fifth one larger than the others, proportionally longer, and curving upward at the outer end, which is truncated so as to form a short side for the support of one of the anal pieces. First radial pieces comparatively large, widening rapidly from below to the top, which is truncated evenly the entire breadth and about twice as wide as the greatest height, all curving under to connect with the subradials below in such a manner that the body rests upon them when placed on a plane surface with the column removed. Second radials a little smaller than the first nearly twice as wide as long, pentagonal in form with lateral margins short and not constricted, each supporting two arms on its superior sloping sides. Arms rather slender for a species of this genus, not being wide enough to be in contact laterally all around when raised vertically. rounded on the dorsal side, rather rapidly tapering, and, so far as can be seen in the typical specimen, all bifurcating on the second piece. Below the bifurcation the two pieces are each about as long as wide, the upper one being sometimes slightly constricted around the middle, arm piece above the bifurcation rather slender, longer than wide, rounded, and distinctly constricted around the middle.

First anal piece about twice as long as wide, and wedged so far down under one side of one of the first radials, by the side of the largest subradial as to come nearly or quite in contact with the very small base. Second anal same and resting upon the short upper end of the larger subradial between the upper part of the first anal on the right and the first radial on the left. Above these the alternating series continues up to connect with the ventral extension.

Ventral prolongation, or so-called proboscis, about equaling the apparent

[Apr

length of the arms, comparatively rather narrow and sub-cylindrical below, but widening rather gradually upward above to the summit, where it flares suddenly out all around to about the breadth of the body below, its top being nearly flat, or much depressed, and composed of small, unequal, convex pieces; while each one of the marginal row of these top pieces, all around, extends horizontally outward in the form of a sharp spine about two-thirds as long as the entire transverse diameter of the flattened top itself.\* Plates forming the sides of the ventral portion, below its flattened spiniferous crown, probably more or less costated, or sculptured, in perfect examples, but the specimen seen is not in a condition to show this, though the usual pores can be seen passing through the sutures between the plates. Surface of body and arms apparently smooth.

Height of body to top of first radials, about 0.18 inch; breadth of do. 0.65 inch; height to top of ventral portion, including the body, 1.20 inches; breadth of the flattened top of the ventral portion, exclusive of the free marginal spines, about 0.50 inch; whole breadth across same to the extremities of the spines.

The form of the body and the arrangement of the anal pieces of this species are very similar to those of our *Z. discus*, from the Upper Coal-measures, but its under side is more decidedly concave, its first radial pieces proportionally higher, and separated by decidedly deeper sutures. Its subradials are also proportionally smaller. From *Z. mucrospinus*, of McChesney, it is at once distinguished by not having its second radial pieces developed into spines, and by the different structure of its arms.

*Locality and position.* Fulton County. Associated with the lowest coal bed of the Illinois Coal-measures.

\* On comparing this Crinoid with Prof. de Koninck's figure of the type of his genus *Hydreionocrinus* (*H. Woodianus*; Bull. de l'Academy Royale de Belgique, 2me serie, tome III, pl. ii), we have been much impressed by the remarkable resemblance of the large ventral extension of its body with its depressed or flattened crown, surrounded by a series of marginal spines directed horizontally outward, to the part in Prof. de Koninck's type supposed by him to be formed by the lateral coalescence of the arms, in such a manner as to form a kind of cylindrical extension of the body upward. In our species, however, there are unquestionably well developed, free arms, independent of this part. It would be such an anomalous structure for a Crinoid belonging to the *Cyathocrinidae*, and otherwise so similar to *Zocrinus* and *Poteriocrinites* as *Hydreionocrinus* is, to have no traces of free arms, that we are tempted to make the inquiry, whether Prof. de Koninck's specimen may not have had its arms broken away and the lower parts of the rays on which they rested accidentally pressed in so as to appear to support the ventral extension; or, in other words, so as to give this part the appearance of being actually composed of the arms themselves united laterally and crowned by a vault? If this upward prolongation of the body was really composed of the arms united laterally, and there were no free arms, with the usual ambulacral openings at their bases, the whole visceral cavity would seem to have been hermetically sealed, excepting perhaps the minute lateral pores we have found to exist in the ventral extension of many analogous forms. Prof. de Koninck distinctly states that he was unable to find any traces of an anal or buccal opening in his type, and we have been equally unable to find any traces of such openings in any of the numerous specimens of *Poteriocrinus*, *Scaphiocrinus*, *Zocrinus*, *Cyathocrinus*, and other analogous forms we have seen, that are provided with a similar large ventral extension of the body. But in all these types there are well developed free arms, with ambulacral openings at their bases. It will be remembered that the genus *Haplocrinus* was supposed to have its arms united to form a kind of conical vault, until Müller discovered a species with true free arms independent of this part.

If *Hydreionocrinus* really possessed free arms, it would otherwise agree so exactly with *Zocrinus* that it would seem to be impossible to separate them even subgenerically: in which case Troost's name would probably become a synonym under *Hydreionocrinus*, as Prof. de Koninck's name was, we believe, published a few months earlier than Dr. Troost's. It is to be hoped that those who may have an opportunity to examine other specimens than those studied by Prof. de Koninck, of the typical species of *Hydreionocrinus*,\* will examine them very carefully to see if some remains of free arms cannot be found.

\* *Hydreionocrinus? globularis*, de Kon., seems to us to belong to a distinct genus nearly allied to *Agassiocrinus*, which in some species has its base distinctly divided into five parts. 1870.]

*ETPACHYCRINUS* BOYDII, M. and W.

Body much depressed, or twice and a half as wide as high to the top of the first radials, rounding inward above the second radials, and under to the very profound central concavity below, composed of thick, strong slightly convex plates. Base very small, and deeply sunken in the concavity of the under side. Subradials comparatively large, convex and curving upward above and under below, and then again upward into the concavity of the under side, where each of them has a mesial indentation or notch, each presenting a general pentagonal outline, excepting two on the anal side, which are modified for the reception of the anal pieces. First radial pieces about twice as high, convex, and equalling the subradials in breadth, all pentagonal in form. Second radial pieces convex, about half as large as the first, which they do not quite equal in breadth, although they are in contact with each other laterally all around thus giving a contracted appearance to the body just above the first radials, each about twice as wide as high, pentagonal in form, and bearing on one superior sloping side an arm, while on the other there rests a smaller secondary radial bearing two arms, thus making, as far as can be seen, three arms to a ray, or if the same structure exists in all the rays, five to the entire series. First or subanal, rather large, nearly quadrangular in form, and resting between the sloping upper sides of two of the subradials, under one side of the first radial on the right, and connecting with the second radial on the left, but apparently not always extending up far enough to have its upper angle truncated by one of the succeeding anals above. Second anal piece considerably smaller than the first, and resting upon the upper truncated side of one of the subradials; above these two or three smaller pieces appear between the arms. Surface smooth. Sutures between the body-plates rather deep.

Arms slightly convex on the outer side, with lateral margins flattened and straight so as to fit closely together when raised up vertically, each composed below of a single range of wedge-formed pieces, but soon passing into a double alternating series above.

Breadth of body across the middle, 0.90 inch; do. across the second radials, 0.64 inch, height to top of first radial pieces, 0.40 inch.

This is a very neat, symmetrical crinoid, unlike any other known to us, and remarkable for having its much depressed body rounding in above, at the top of its first radial pieces, so as to be very distinctly narrower across above the top of the first radials than below. Its sides also round very neatly under below, and so far into the deep concavity of the under side that the lower (inner) ends of the subradial pieces curve upward into the mesial concavity nearly as far up as their outer or upper ends. It seems to be the same form figured by Prof. Vandell and Dr. Shumard in their "Contributions to the Geology of Kentucky," (see fig. 4 a, b), without a description or name, from near Grayson Springs, Kentucky. The specific name is given in honor of Dr. Boyd, of Chicago, to whom we are indebted for the use of the last specimen seen.

*Locality and position.* Chester, Illinois. Chester division of the Lower Carboniferous limestone series.

*HOMOCHINUS* ARGUSTATUS, M. and W.

Body below the first radial pieces more or less obconic, or somewhat constricted below the middle. Base forming a narrow cup, sometimes nearly as high as wide, with vertical sides, composed of convex pieces, once and a half to nearly twice as wide as high. Subradial pieces as long as the basals, or sometimes a little longer, and always wider, more or less convex, all hexagonal excepting one on the anal side, which is heptagonal. First radial pieces nearly one-third wider than high, being as wide as the subradials but shorter, and not so tumid; all pentagonal, with the upper side truncated the

[April

entire breadth. Succeeding radials, of which there are three in each of the rays seen,\* as wide as the first, but much shorter, or only one-third to one-fourth as long as wide, thus forming free arms so wide as to be nearly in contact all around, excepting on the anal side; last or fourth radial supporting upon its superior slightly sloping sides, the first divisions of the arms, which, at least in one of the posterior, and one of the lateral rays, bifurcate on the third piece, while some of the divisions appear to divide again on the fourth piece, which is as far as they can be traced in the specimens examined. Column large, or nearly two-thirds as wide as the base, at its connection with the latter; but suddenly tapering downward, and, at least in one of the examples, ending with the sixth piece in a rounded point, evidently showing this individual to have been free at maturity. Connecting, or upper joint, of the column in the only two examples seen, very thick, and in one quite tumid.

Height to summit of first radial pieces, 0.48 inch; breadth of do., 0.50 inch; height of base, 0.20 inch; breadth of do., 0.24 inch; breadth of rays below the first division, 0.17 inch.

This species seems to be most nearly related to *H. polydactylus* of Shumard, from which it differs in the remarkable narrowness of its base, and the proportional greater thickness of its column. It also differs in having only three to four primary radials to each ray, instead of five to six.

*Locality and position.* Mount Carroll, Illinois. Cincinnati Group of Lower Silurian.

#### Genus CODONITES, M. and W.

In the Proceedings for April of last year, page 84, we proposed, in a note, to found a new genus under the above name, for the reception of *Pentremites stelliformis*, of Owen and Shumard. This genus agrees with *Pentremites* in structure, excepting that its openings corresponding to those usually called the ovarian apertures (*Hydrospires*, of Mr. Billings), instead of forming with the larger opening, usually called the anus, five round apertures, appear at the surface as ten elongated slits, widest at the upper and inner ends, and situated one on each side of each of the so-called pseudo-ambulacra.† Again its aperture, corresponding to that usually considered the anus in *Pentremites*, is proportionally larger, more remote from the center of radiation, and completely disconnected from the so-called ovarian opening on each side of it. As in *Pentremites*, the central hiatus is covered by small plates in perfect specimens, and from this little disc of plates two rows of minute alternating pieces are seen to extend out, so as to cover each of the little ambulacral furrows, passing along the middle of each pseudo-ambulacral area and under the central disc, into the covered central aperture. These little covering plates of the furrows probably extended the whole length of the pseudo-ambulacra, but were doubtless movable, or capable of opening along the middle, being in fact marginal ambulacral pieces.

As in the genus *Pentremites*, we also observe in this type three pieces anchylosed to the bottom of the busasal pieces, with the sutures between them exactly coinciding with those separating the three busas pieces; these we propose to call supplementary basal pieces.‡ The internal folds, or compressed

\* The right posterior ray seems to be an exception to this statement, as it appears to have only three radials including the first, with the second one nearly as large as the first. Its parts, however, are not well preserved.

† We regard these, as elsewhere stated, as really recumbent arms, similar to those of some Cystoids.

‡ Mr. S. S. Lyon was the first author, so far as we are informed, who called attention to these lower pieces in *Pentremites*; and he showed that they are really separable from the basal pieces, in some cases (See Owen's Geol. Report of the Kentucky Survey, vol. 3, p. 468). He, however, regarded these pieces as the true base, and those usually so considered, as subradials. At one time we were inclined to adopt this view, as has been recently done by Mr. Billings, in an interesting paper on the structure of the Blastoids and other types, published in the American Journal of Sciences and Arts, for July, 1869. The fact, however, that these lower pieces do not alternate with the range above, that Mr. Lyon's view

tubes of thin calcareous matter under the pseudo-ambulacra, and connecting with the inner ends of the slits representing the so-called ovarian pores are also constructed as in *Pentremites*, excepting that here there are two of these tubes under each pseudo-ambulacral area, while we have not seen more than eight in any of the true *Pentremites*, nor more than four in *Granatocrinus*, though we are not positively sure that these numbers will always be found to hold good as generic distinctions.

Compared with *Colobites* the type under consideration is found to differ in having only two of the slits mentioned in each of the anal and interradial areas instead of about eight to sixteen, while it has three slits equally in the anal and interradial areas, instead of only in the latter, as in *Colobites*. It also differs from that genus in having the internal folds or compressed tubers under the so-called pseudo-ambulacra, instead of extending under the whole interradial areas.

Since proposing this new genus, we have received from Mr. Wachsmuth fine specimens of another species of this type which, although widely different specifically, from the typical species, still exhibits very clearly the same generic characters, as will be seen from the following specific description.

#### CODONITES GRACILIS, D. and W.

Body comparatively small, pentagonal-suboval, longer than wide, the widest part being at the lower extremities of the so-called pseudo-ambulacral tube which terminates a little below the middle. Supplementary base small, very short, or only appearing to be composed of a single tripartite joint of the column. Base low, or near three times as wide as high, expanding rapidly upward, and pentagonal in outline, as seen from below. Basal pieces of moderate size two pentagonal and one hexagonal. Radial pieces nearly twice as long as wide with a general oblong outline though they are a little wider at the middle than above or below while the superior lateral angles are a little truncate by the anal and interradial pieces and the lower end is rounded or somewhat obtusely angular in outline at the middle, all rather distinctly convex below the middle, so called pseudo-ambulacral sinuses narrow and very slightly tapering extending down a little below the middle, where they each terminate at a little pointed projection, which is directed horizontally outward, so as to add to the pentagonal form of the body, as seen from above or below. Anal piece of moderate size, wider and more obtuse below than the interradials, and narrowed above, with a comparatively large anal opening nearly dividing it a little below the middle, where it is very contracted. The

would require should be considered subradials, would none be an objection to this conclusion. It is also worthy of note that when these lower pieces are removed we find the next range of pieces above closed together so as to form the bottom of the visceral cavity, as true basals. Again in those species of *Granatocrinus* like *G. Noronhai* etc. a deep cavity in the under side we find the pieces corresponding to those Mr. L. says there are the sub-basals as it were pushed inward, and forming a little pyramid at the bottom of the visceral cavity, precisely as we see the true basals in various types of *Granatocrinus* with a sunken base. In addition to this, although all specimens of the type here under consideration have this lower part, supposed by Mr. L. to be the true base, as so called in the true *Pentremites* young individuals show that it is actually composed of five or six of the upper joints of the column enlarged and anchored together. But there are arguments of the upper joints of the column of various types of *Crinoids* are known. For instance, in *Perthesocrinus* and its allies, in *Therapsocrinus*, *Apocrinus* etc. it is true that in these the enlarged part is not divided longitudinally by sutures as in *Pentremites*, *Crinoides* etc. This fact however will be seen to be of less importance when it is remembered that there are examples of true *Crinoids* with the column longitudinally divided, and for instance, as in *Baryocrinus*, where we see the whole column divided into five or six segments nearly through its whole length. And here the true sutures of the column coincide with those between the five true basal pieces, exactly as the three sutures between the supplementary basal pieces in *Colobites* and *Pentremites* coincide with the three between their three basal pieces.

\* We have several times thought we could see indications of sutures dividing the anal piece of *Colobites deflexus* and *Granatocrinus Noronhai* into three pieces. That is, a transverse suture at the anal opening and a longitudinal one dividing the upper or inner half into two pieces. Some casts of the interior of *G. Noronhai* seem to show this distinctly.

[Apr]

terradians more than twice as long as wide, the widest part being below, while the central region is much contracted, and the upper part, like that of the anal piece, somewhat dart-shaped, and a little concave, with a smaller tubercle occupying the middle of the little concavity.

So-called pseudo-ambulacral fields rather narrow, somewhat convex, with mesial or ambulacral furrows rather wide and deep, particularly above the middle; pore or arm-pieces, about twenty-two on each side of each area; lancet pieces very narrow, but thick, and rather deeply furrowed along the middle above, where they form the bottom of the ambulacral furrows; farther down, the pore pieces close in so as nearly or quite to cover the lancet pieces at the lower end. Elongated slits corresponding to the openings usually called ovarian apertures in *Pentremites*, widest at the upper end, and extending down apparently three-fourths of the length of the pseudo-ambulacral areas, so very close to the margins of the latter as scarcely to leave more than a thin intervening space above, and apparently none below. Central hiatus very small, and doubtless covered by minute plates in perfect specimens.

Surface distinctly ornamented with very regular, well-defined striæ, running parallel to the upper margins of the basal pieces, and to the inferior and lateral margins of the radials. Along the margins of the pseudo-ambulacral areas, narrow flattened, or very slightly concave spaces are seen extending along the surface of the radial pieces, and corresponding to the rather broad, deep furrows seen occupying the same position in the typical species, *C. stelliformis*. (Column and pinnulæ unknown.)

Height, 0.60 inch; breadth, about 0.50 inch.

This species, although agreeing with *C. stelliformis* in the important characters distinguishing this genus from *Pentremites* and *Codaster*, differs so materially in form and other specific characters, as to render a comparison unnecessary. In general form it much more nearly resembles the true *Pentremites* than the typical form of *Codonites* does. It must be very rare, as we are not aware that more than the one specimen has ever been found.

*Locality and position.* Lower division of the Burlington group of the Lower Carboniferous, at Burlington, Iowa. Mr. Wachsmuth's collection.

#### PENTREMITES BURLINGTONENSIS, M. and W.

Body attaining a medium size, ovoid, or ovoid-subglobose, depressed and short below, and rounded and more produced above. Supplementary base very small, or only one-fourth as wide as the base, rounded and firmly anchylosed to the true base; short, or apparently composed of not more than three anchylosed segments from the upper end of the column. Base of moderate size, much depressed, or having the form of a pentagonal dish. Radial pieces once and a half as long as wide, rather narrow below, and widening upward to near the middle, above which they are very slightly contracted to the top; each divided three-fourths of its length by its rather wide pseudo-ambulacral sinus. Anal and interradian pieces very small, exposed part presenting an elongate rhombic outline, the upper part being more elongate and acute than the lower. So-called pseudo-ambulacral areas\* wide, moderately convex, tapering rather gradually below the middle, and more abruptly above; so-called pore pieces about 35 on each side of each area, less than half as long, transversely, as the breadth of the exposed part of the lancet pieces at their widest part, nearly transverse above, but becoming somewhat oblique toward the lower part of the area; supplementary pore pieces small. Lancet pieces exposing a wide, lanceolate form, being widest above the middle, gradually tapering below, and contracting abruptly above; each with its mesial or ambulacral furrow rather wide and deep, and minutely crenate within; transverse

---

\* Although we use here the usual term for these parts, we really regard them as recumbent arms, similar to those seen in some *Cystoidea*.

furrows well defined, and also minutely crenate. Central hiatus small. So-called ovarian openings small, and those distinct from the anal opening appearing at the surface as four pairs of closely approximated elongate-oval pores. Anal opening comparatively large, and, as usual in the genus, including one of the pores on each side. Surface ornamented with five parallel striae, running as usual in allied species.

Height of one of the smaller, less globose specimens, exclusive of the little supplementary base, 0.50 inch; breadth, 0.49 inch. Height of a large, more ventricose specimen, 0.87 inch; breadth of do., 0.84 inch.

This species has much the form and general appearance of the common *P. Godoni*,—so much so, indeed, that those who give wide limits to species would probably fail to observe any well defined differences. On comparison, it will be found to differ, however, in the following characters, viz.: In the first place, its pseudo-ambulacral areas are more convex, and not bounded by near such sharply elevated margins of the radial pieces. Its pore pieces are also larger, and scarcely more than half as numerous as in *P. Godoni*. Its anal and interradial pieces are likewise decidedly smaller than in that species, while it also presents the well-marked difference of having its so-called ovarian openings with each pair appearing at the surface, as two closely approximated, but distinct elongate-oval pores, instead of as a single round, larger opening. It moreover holds a much lower geological position than *P. Godoni*.

It is the first true, typical *Pentremite* we have seen with each pair of ovarian pores (so-called) appearing as two distinct pores at the surface. It must be quite rare, as only three specimens have come under our observation.

*Locality and position.* Upper division of the Burlington group of the Lower Carboniferous, at Burlington, Iowa. No. 387 of Mr. Wachsmuth's collection.

#### OLIGORONTS COREYI, M. and W.

Body small, subglobose, or apparently depressed-globose, and deeply sulcate; composed of moderately thick plates; apical region sunken. Inter-ambulacral areas twice as wide as the ambulacral, very convex, and rounded over from side to side; composed at the middle by six ranges of plates, which decrease in numbers to apparently about three ranges, at the upper and lower extremities of the areas. Ambulacral areas deeply furrowed along each side, and rising into a rather prominent ridge along the middle; composed of somewhat irregular plates, as to size and form, but clearly showing but two rows on each side of the mesial zig-zag suture, the outer range being gener-

## BRACHIOPODA.

## CHONETES?? MILLEPUNCTATA, M. and W.

Shell attaining a large size, very thin, transversely subsemicircular, or more than twice as wide as long, with lateral extremities rounded. Dorsal valve nearly flat, or but slightly and evenly concave; hinge line a little less than the greatest transverse diameter; cardinal process rather stout, with an obscure linear ridge (or sulcus) extending forward from its base nearly to the front; cardinal edge slightly thickened within, so as to form a faintly defined ridge extending about half-way from the cardinal process toward each lateral margin, but apparently without any trace of sockets for the reception of teeth in the other valve; muscular and other internal markings unknown; surface ornamented by numerous slender, exceedingly regular, closely arranged concentric lines, exactly parallel with each other and the front and lateral margins. (Ventral valve unknown.)

Length of a medium sized specimen, 1.30 inch; breadth, 2.95 inches. Largest examples seen, 2.10 inches in length, and of nearly the same proportional breadth as the others.

Of this very remarkable shell we have seen six or eight specimens, and some fragments of others. All of the specimens yet found, however, are dorsal valves only, the ventral valve being entirely unknown to us. The slightly worn, or more or less weathered condition of the specimens has obliterated whatever muscular or other internal markings there may have been. In most cases only patches of the shell itself remain, though, even in these cases, the general outline and external surface markings are very distinctly defined in the matrix. All of the specimens show a rather obscure, linear, internal sulcus extending from the base of the cardinal process nearly to the anterior margin. This, however, is probably caused by the accidental removal of a linear mesial ridge, because we also see it equally defined in impressions of the external surface of the valve left in the matrix, just as would be the case if a firm internal ridge had been, owing to the thinness of the shell, as it were, pressed through. The concentric lines of the surface present an extraordinary degree of regularity, both in size and arrangement. On a medium sized dorsal valve about sixty of these lines may be counted, while some of the largest show twice as many. They are of exactly the same size and distance apart on all the specimens, and of so nearly the same size on all parts of the same individual as to appear to the eye to be exactly uniform throughout. By measurement, however, we count fifteen of them in the space of 0.25 inch near the margins of a medium sized specimen, and twenty in the same space near the beak. In a few instances we have observed what seemed to be the faintest possible traces of a few larger radiating lines or costæ, near the middle of the anterior margin of the dorsal valve. None of the specimens show the cardinal process entire, but as far as its characters can be made out it seems to have been much as in *Chonetes*.

The most remarkable character of this shell, however, remains to be mentioned. That is, its extremely coarse punctate structure, and the unusually close arrangement of the punctures, which are so large as to be nearly visible to the unassisted eye. As seen by the aid of a common single pocket lens, they present, on the inner surface of the dorsal valve, much the appearance and arrangement of the cells of a delicate *Chæteles*, the spaces between them being much less than the diameter of the pores themselves. They appear to diminish rapidly in size, however, as they approach the external surface, near which they seem to be a little less than the diameter of the spaces by which they are separated. As we have never seen such a shell structure as this in any species known to possess the characters of the genus *Chonetes*, nor indeed in any other known Brachiopod, we are very strongly inclined to believe our shell really belongs to an undescribed genus. The fact that there appear to be no sockets in the cardinal margins of its dorsal valve, for the reception of

1870.]

teeth in the other valve, would also favor the conclusion that it is not a true *Chonetes*. Nevertheless, we prefer to place it provisionally in that genus, until specimens can be obtained showing the dorsal valve, with the muscular impressions and other generic characters. Should it be found, as we believe it will, to be a new generic type, we would suggest for it the name *Isogramma* (*isos*, equal; *γραμμα*, a line), in allusion to the remarkable equality of the concentric lines of the surface.

To whatever genus our shell may really belong, it is evidently very closely allied, even specifically, to a form figured by Mr. Davidson from the Carboniferous limestone of Scotland, in his valuable Monograph of the British Carboniferous Brachiopoda, vol. II, part v, pl. IV, fig. 13. Mr. Davidson referred his shell, with much doubt, on the authority of Dr. De Koninck, to *Chonetes concentrica*, of the latter author. We fully concur with Mr. Davidson, however, in the opinion that it is distinct from Prof. De Koninck's\* species, as it is much longer, and instead of being marked with only 12 to 13 large concentric ridges, has about 37 regular, more concentric lines. In our species there are about twice the number of lines seen on that figured by Mr. Davidson, in specimens of the same size; and as this character is remarkably uniform in all our specimens, we cannot believe it otherwise than a specific difference.

*Locality and position.* Upper Coal Measures, Marion County, Illinois, where it occurs associated with nearly all the fossils in the Upper Coal Measures of Kansas and Iowa, and in those in Nebraska referred by Profs. Marcon and Geinitz to the Permian.

#### *SPINIFER FASCIATUS*, M. and W.

Shell attaining a rather large size, moderately convex, very transverse, or distinctly more than twice as wide as long; greatest breadth on the hinge line; lateral extremities very attenuate and acutely pointed in young specimens, but becoming more obtuse in larger individuals; front and anterior lateral margins broadly and rather regularly rounded. Dorsal valve nearly as convex as the ventral; beak depressed, somewhat incurved, and scarcely projecting beyond the hinge line; area of rather more than usual breadth for that of a dorsal valve, and arched with the beak; mesial fold commencing at the beak scarcely larger than one of the ribs on each side of it, but increasing gradually in breadth and prominence to the front, where it is occupied by about six to eight costae, which, however, coalesce into one or two at the beak. Ventral valve regularly convex over the central region, and somewhat compressed toward the lateral extremities, mesial sinus commencing narrow

ing striæ, and a few stronger marks of growth may be observed on well preserved specimens, the striæ, however, excepting near the front and lateral margins, not being readily seen without the aid of a magnifier.

Length, about 1.45 inches; breadth, 2.20 inches; convexity, about 1.50 inches; height of area at the beak, 0.26 inch.

We have had specimens of this fine *Spirifer* under consideration for a long time, and after numerous careful comparisons, we have been unable to identify it with any of the described species. It seems to be most nearly allied to our common Coal-Measure species *S. cameratus*, of Morton, with which it agrees in the fasciculated character of its costæ, and in general appearance. It differs, however, in several characters by which it can be readily distinguished on comparison. In the first place, its larger fasciculated costæ are distinctly broader, and rather more depressed on the anterior slope of its valves, and proportionally less numerous. The incurved apex of the beak of its ventral valves is always less abruptly curved, and much more flattened. The most marked character, however, is to be observed in its cardinal area, which has its margins almost perfectly parallel, instead of being always sloping from the beak to the lateral extremities. The same characters and its narrow mesial fold and sinus distinguish it from the variety of *S. striatus*, with somewhat fasciculated costæ. It belongs to the subgenus *Trigonotreta*.

*Locality and position.* Keokuk division of the Lower Carboniferous series, at Crawfordsville, Indiana.

#### STRICKLANDINIA DEFORMIS, M. and W.

Shell (internal casts) longitudinally subovate, oblong, or sometimes in young examples nearly or quite as wide as long; valves very nearly equal, and sometimes showing very faint traces of an obscure mesial prominence on the dorsal valve, and of a corresponding depression near the front of the ventral valve; hinge line straight, and less than the breadth of the valves; surface apparently smooth, or only with concentric lines on the young shell, while casts of the adult show some traces of a few obscure, irregular, radiating ridges. Beaks, area and finer surface markings unknown.

Length of a young internal cast, 1 inch; breadth, 0.97 inch; convexity, 0.46 inch. Length of a large specimen, 1.93 inches; breadth, 1.58 inches; convexity, 1 inch.

This shell varied so greatly in form at different stages of its growth that it is very difficult to give a description that will convey a correct idea of it. Young examples from 0.70 to one inch in length, approach a broad obovate form, being truncated on the hinge line, and somewhat narrowly rounded at the middle of the front; while their posterior lateral margins are more or less straightened and inflected, as we often seen in *Rensselaeria*. After attaining this size and form, the shell, judging from some four adult examples we have seen, seems to have suddenly commenced a more vigorous growth, mainly forward and antero-laterally, so as to attain a much larger size, leaving the valves of the young shell, as it were, opened and spread upon the beaks, thus completely destroying the symmetry of the entire shell. At this stage of growth the shell has a curious constricted appearance at the connection of the young and adult shell; while the whole breadth posteriorly is only that of the young shell, and the widest part is then some distance in advance of this, and the posterior margins are strongly flattened by their sudden inflection towards each other there.

The casts show that the chamber in the beak of the ventral valve is of moderate size, and supported upon a rather short mesial septum. The socket processes are seen, by their impressions in the cast, to be small, not united, and scarcely assuming the character of plates; while the crural processes extended from their inner lower sides forward nearly parallel, so as to leave two slender, deep perforations in the cast. The surface of the young shell appears

to have been smooth, or only marked with the concentric striæ, but internal casts of large individuals sometimes show very faint traces of a few broad, irregular, radiating, flattened ridges.

It is probable that this species is most nearly allied to *Strecklandina Dorrisi*, of Billings (Geol. Mag. vol. v, pl. iv, fig. 1, 1a), which, in some stages of its growth, it resembled rather nearly in form. In all the large examples, however, it differs extremely from that shell in its remarkable narrowness across the umbones, and its truncated or flattened posterior lateral margin. Its front is also less produced and less narrowly rounded in the middle than these larger specimens.

*Locality and position.* All the specimens of this species we have seen were found loose in Carroll County, Illinois, near rocks of the age of the Niagara group. They are all in the condition of white quartz casts of the interior.

## LAMELLIBRANCHIATA.

### MONOTIS ? GREGARIA.

Shell very small, extremely thin, compressed, oblique, varying from truncate-suboval to subcircular; hinge line less than the breadth of the valve; auricles small, obtusely angular, undefined by any sinuosity of the margins; posterior (?) margin rather regularly rounded in outline, and rounding into the palatal margin; anterior (?) border prominent below and rounding into the base, but straight and ascending with a backward slant to the hinge teeth located near the middle of the hinge line, above which they seem to arise. Surface marked by extremely fine concentric striæ, and a few somewhat larger furrows or wrinkles of growth, crossed on the anterior (?) half of each valve by small radiating costæ, generally not defined near the anterior (?) margin.

Antero-posterior diameter, 0.25 inch; height, or diameter at right angles to the hinge, 0.20 inch; convexity unknown.

Of this little shell we have numerous specimens, all compressed to extreme flatness on the surfaces of the laminae of shale, many of them lying with the two valves opened out and connected by their hinge margins. As thus seen, their small size causes them to appear much like the valves of *Pseudonocardia*, or those of some of the little phyllopod Crustacea. This form, however, if found, on closer examination, to be different, while the radiating costæ would indicate different affinities. Some individuals are a little wider proportionally, in their antero-posterior diameter, than that from which the above measurements were taken and these have much the outline of the left valve of some forms of *Aviculopecten*, excepting that the auricles are not in the slightest degree defined (in either valve) by any traces of a marginal sinus.

It is possible that this little shell may be a true *Lima*, as it has much the form of some species of that genus, and there certainly are in the Western Coal-measures, two or more species apparently agreeing in all respects with that genus. If a *Lima*, of course the side we have described as the anterior must be the posterior, and *vice versa*. The reasons for doubting its relation to the genus *Lima*, however, are, (1), its extreme thinness, (2), the fact that it seems to have a prismatic structure, and (3), its very small size. It is possible, however, that the extremely thin fibrous shell, as we now see, may consist only of the external lamina, left after the decomposition of the inner layers. If so, and the fibrous appearance is really the original structure, it would more probably belong to some perhaps undescribed genus, allied to *Aviculopecten* of the family *Aviculidae*. If a true *Monotis* it would be the only known species of that genus in our Carboniferous rocks, the common Western Coal-measure shells usually referred to that genus belonging to a very distinct group, to which Beyrich has applied the name *Pseudomonotis*.

*Locality and position.* Jacksonville Shaft, Illinois, from near the middle of the Coal-measures.

[April

## AVICULOPECTEN SPINULIFERUS, M. and W.

Shell of medium size, rather compressed, having a moderately oblique, truncato-suboval, or suborbicular outline. Hinge apparently nearly equaling the antero-posterior diameter of the shell; ventral margin forming a broad semiovate outline, being more abruptly rounded up behind than in front. Posterior wing rather pointed, apparently not quite as long as the rounded margin of the valves below, from which it is separated by a rounded sinus. Anterior wing compressed, narrow, as long as the anterior margin of the valves; in the left valve pointed, and separated from the margin below by a narrowly rounded, rather deep sinus. Beak of the left valve moderately prominent, and placed a little in advance of the middle. Surface of same valve ornamented with numerous, distinct, unequal, radiating costæ, arranged usually with one or two smaller ones between each two of a somewhat larger series, the latter of which bear numerous little round, regularly arranged, somewhat oblique spines; crossing the whole there are also numerous minute concentric striæ. (Right valve unknown.)

Height of left valve, about 1.50 inch; antero-posterior diameter, near 2 inches.

This is a delicate species, apparently with thin valves. Its costæ seem to be nearly equally developed over the whole of the left valve, including the wings, or at any rate the posterior one. On the body of this valve, near the ventral margin, about five of the larger spiniferous costæ, and some six or eight of the smaller non-spiniferous ones may be counted in the space of half an inch. The spines of the larger costæ were short, round and pointed (not being formed by vaulted laminæ of growth), and arranged along these costæ at regular intervals of about 0.10 inch apart, those at the ventral margin being larger than the others, and projecting a little below the border. An impression of a part of the anterior wing of the right valve shows that it was distinctly costate, two or three of the costæ running nearly parallel to the hinge margin, and bearing short spinules.

In casts of this species without the spines, the costæ present much the same subnodose appearance as those seen on *A. fallax* (= *Pecten fallax*, McCoy, Carb. Foss. Ireland, pl. 14, fig. 2), but that species seems to have had no spines. It is also much less oblique, and higher in proportion to its antero-posterior diameter.

We place this species in the genus *Aviculopecten* only provisionally, as we have not seen its hinge. It is highly probable that there are a number of undescribed genera among the Palæozoic species usually included in the genus *Aviculopecten*, or wrongly referred by some to the genus *Pecten*.

*Locality and position.* Crawfordsville, Indiana. Keokuk division of the Lower Carboniferous series.

## Genus CARBONARCA, Meek and Worthen.

Shell (as determined from internal casts) equivalve, inequilateral, very convex, transversely oblong or oval; umbones gibbous, prominent, and strongly incurved with subangular or prominent posterior slopes; valves closed all around, with smooth margins; ligament external; cardinal margin a little arched, with, at the anterior extremity in each valve, two rather oblique, comparatively stout teeth, and extending along its entire length from immediately behind these, a row of minute interlocking teeth or crenulations, as in *Arca*.

This genus seems to belong to the *Arcidæ*, near *Isoarca*. It differs, however, very decidedly from that genus, in having, in addition to the small interlocking crenulations along the whole length of the hinge, two well developed and independent larger teeth at the anterior end of the hinge. The specimens seen are all internal casts, but an impression of the hinge of a right valve, in the matrix, shows its characters very clearly. There is no  
1870.]

gradation from the series of minute teeth into the two large ones at the anterior end of the hinge, the first of the smaller series immediately behind the two larger ones being as minute as any of those farther back so that the contrast between the two sets of teeth is well marked and abrupt. The hinge margin was doubtless provided with a cardinal area, but as we only have a lateral cast, it has not yet been seen.

#### CARBONACEA GIBBOSA, M. and W.

Shell transverse, short-oblong, very convex, posterior side wider than the other and vertically subtruncated; anterior margin rather narrowly rounded; ventral margin nearly straight along the middle, but sloping and rounded up anteriorly, and more abruptly behind, cardinal edge equaling two thirds of the whole length; larger anterior teeth inclined forward and upward and those of the small series ranging nearly vertically or slightly inclined forward anteriorly, and a little backward behind, umbones gibbous, but with the outer and upper surfaces a little flattened, so as to impart a slightly subangular or prominent character to the post-umbonal slopes; immediate apex of the strongly incurved beaks placed about one-fourth the entire length of the shell behind the anterior extremity. Surface markings unknown.

Length, 0.82 inch; height to top of cardinal margin (of cast) behind the beaks, 0.56 inch; do. to top of umbones, 0.65; convexity of the two valves, 0.57 inch.

*Locality and position.* Springfield, Illinois; Upper Coal measures. Also same horizon at LaSalle, Ill. The specimens from the latter locality are in some examples more depressed and oblique than the typical form from near Springfield, and these may possibly belong to a distinct species, if the differences noted are not due to accidental distortion. If really distinct, this form might be called *C. depressa*.

#### \* MACRODON DELICATUS, M. and W.

Shell small, about twice and a half as long as high, moderately convex, elongate rhomboidal in outline, posterior margin obliquely truncated, so as to be angular at the base; cardinal margin about three fourths the entire length and nearly parallel with the base, anterior extremity very narrowly rounded; basal margin nearly straight along the middle, but rounding very gradually upward anteriorly, beaks depressed, and placed about one fourth the entire length of the valves behind the anterior extremity; posterior umbonal slopes subangular from the beaks obliquely backward and downward to the sharply rounded or subangular posterior basal extremity, while the apices behind and above these slopes are compressed or slightly concave. Surface marked by small ridges and lines of growth, which are crowded by raised radiating lines or linear costae, rather widely separated posteriorly, but more closely arranged, and less strongly defined toward the front part of the valves. (Cardinal area, hinge and muscular impressions unknown.)

Length, 0.45 inch; height, 0.19 inch; convexity, about 0.11 inch.

This little shell will be readily distinguished from its associate formerly described by us under the name *M. tenuistriatus*, by its much more oblique and less gibbous form; but more especially by having its linear radiating costae separated by wide intervening spaces, instead of being closely crowded together. Indeed, we know of no species with which it could be confounded.

*Locality and position.* Springfield, Illinois. Upper Coal Measures.

\* In the Proceedings of the Chicago Academy of Sciences for March 1868, p. 17, we suggested that in case the name *Macrodon* Lycett could not be retained for this genus because it had been previously used by Muller for a genus of fishes that it is now called *Paraleidon*. In that case the name of this species would have to be written *Paraleidon delicatus*.

## MODIOLOPSIS SUBNASUTA, M. and W.

Shell rather small, elongate, narrow and slightly arcuate, rather distinctly convex, the most gibbous part being along the posterior umbonal slopes, above the middle; dorsal and ventral margins slightly diverging posteriorly, so as to make the widest (highest) part of the valves nearest the posterior end, while the most sinuous part of the ventral margin is a little in advance of the middle; anterior end narrow, a little produced, with an oblique forward slope of its upper margin, to its narrowly rounded extremity; posterior margin somewhat cuneate, with an oblique truncation more or less convex in outline, to the posterior basal extremity, which is narrowly rounded; cardinal margin long and a little arched; beaks much depressed, and placed rather nearer the anterior edge than to the middle; posterior umbonal slopes prominent, and forming an obtuse ridge, which extends obliquely backward to the posterior basal edge of each valve; anterior muscular scar comparatively large, round, shallow, and placed near the edge of the valves; small pedal muscular scars distinct just above those of the anterior adductors; surface of internal cast showing moderately distinct, irregular, concentric undulations, which are most strongly defined below, and in front of the posterior umbonal slopes, on the flattened or concave flanks.

Length, 1.31 inch; height, 0.50 inch; convexity, 0.40 inch.

This is a neat, symmetrical shell, resembling *M. nasuta*, Conrad (sp.), but differs in having the narrowed anterior end less produced, the beaks being placed farther forward; while its posterior end is broader, and obliquely truncated, instead of being rounded. Its general outline is more like that of *Orthonota contracta*, Hall (Palæont. N. Y., vol. i, pl. 32, fig. 8), though its lower margin is less distinctly sinuous, its beaks more depressed, and its posterior margin more oblique; while it wants the oblique dorsal wrinkles seen on casts of that shell, being a true *Modiolopsis*.

Compared with foreign species, our shell is found to be very closely allied to an English Upper Silurian species described by Mr. Salter under the name *M. platyphylla*. Our shell, however, has the anterior end narrower and more produced, with more prominent posterior umbonal ridges.

*Locality and position.* Galena Limestone of the Lower Silurian, in Carroll County, Illinois.

## SCHIZODUS AMPLUS.

Shell attaining a large size, as determined from internal casts, moderately convex, oblong-suboval in outline, or about one-fourth of its length longer than high; anterior side short, rounding from above the middle into the base; outline of ventral margin forming a broad semi-ovate curve; posterior margin nearly vertically subtruncated, but rounding abruptly into the dorsal margin above and into the base below; cardinal border nearly straight, and sloping very slightly from the beaks posteriorly; beaks much depressed, nearly anterior, incurved, closely approximated, and directed forward and inward. Posterior adductor muscular scar shallow, rather large, suboval, and located close up under the posterior extremity of the hinge; anterior do., smaller, deeper, subovate, and placed very near the anterior margin a little above the middle, with rather distinct, nearly detached, pedal muscular scars at their upper ends. Posterior umbonal slopes with each a distinct sulcus extending from the beaks obliquely backward and downward, becoming wider and more shallow as they descend, so as to die out before reaching the posterior basal margin. (External surface unknown.)

Length of cast, 2.60 inches; height of do., 2.15 inches; convexity, 1.56 inches.

This is the largest species of *Schizodus* (if it belongs to that genus) we have yet seen. Our only specimen is an internal cast, giving no idea of the nature of the hinge. From its general appearance, however, and the nature of its 1870.]

muscular and simple pallial scars, together with the remains of its external ligament, we can have little doubt in regard to its being a *Schizodus*. In size and general outline, its internal cast closely resembles *Amphicardia Leidy*, described by Prof. Hall from the Upper Silurian Limestone at Bridgeport near Chicago. It has, however, obviously no near relations to that shell. For a *Schizodus*, its beaks are unusually depressed and oblique. We know of no other species resembling it in general form.

Compared with *Schizodus occidentalis* (= *Cypriocardia ? occidentalis*, Swallow), which seems to be a true *Schizodus*, and agrees with our shell in size, it is at once distinguished by its much more depressed beaks, less convex valves, and broadly round posterior outline. Prof. Swallow's species also occurs in our Coal Measures, but we have yet only seen it from a higher part of the series, at LaSalle.

*Locality and position.* Seaville, Fulton County, Illinois, Coal No. 1 of Coal Measures.

#### SCHIZODUS (PRISCONAIA) PEREZLEGANS, M. and W

Shell attaining a moderately large size, ovate-subcordate in general form, very gibbous, apparently closed all around, rather thin. Anterior and posterior views presenting a neat cordate outline. Pallial margin semioval, the most prominent part being in front of the middle, anterior side very short, and rounding up abruptly from below; posterior side narrowly rounded or subangular, hinge line apparently rather short. Beaks very gibbous, prominent, pointed, and strongly incurved, so as to bring their points nearly or quite in contact, located near the anterior margin; lunule excavated, but not distinctly defined. Surface appearing to the unassisted eye almost perfectly smooth, excepting very regular, raised, concentric striae, or small costae on the anterior part of the valves, with obscure traces of smaller striae crossing the same. Under the highest power, however, that can be well used as a hand magnifier, the whole surface is seen to be covered by an extremely minute, perfectly regular, crowded sculpturing, as if made by crowded, minute cross lines, entirely invisible even under a good common pocket magnifier.

Height of a small specimen, 0.90 inch; convexity of same, 0.80 inch, length, about 1.18 inches. Other imperfect specimens show that the species sometimes attained three or four times the size of that from which the above measurements were taken.

The extremely minute ornamentation mentioned on this shell may be properly considered microscopic, being entirely invisible under a good common pocket lens, by the aid of which it shows apparently an almost polished surface. When examined in a strong light, however, with a sufficiently high magnifier, the finer markings are seen to present a delicacy, fineness, regularity, and beauty that art could scarcely attain, even by the aid of the most accurate mathematical ruling machine. In some specimens this delicate marking has been, in places, partly removed, as if by the abrasion of an extremely thin external layer, or epidermis, to which it appears to be to some extent, confined. When this layer has been in this way removed, however, traces of the same marking can be seen on the surface of the layer beneath by the aid of a sufficiently strong magnifier.

The stronger concentric, raised striae, or small costae, seen on the anterior part of the valves, do not run exactly parallel to the very obscure marks of growth, but cross them obliquely. On following these little costae back toward the gibbous part of the valves, they all seem to become suddenly obsolete; but on examining them with a common pocket lens, they are seen to be continued over the convex part of the valves, as minute, impressed hair-lines, very regularly disposed, so as to leave comparatively rather wide spaces between. Here, too, they are seen not to be exactly parallel to the faint marks of growth, and on following them back they are observed to terminate suddenly at a similar impressed hair-line, descending with a slight curve from

[April

the posterior side of each beak, apparently to near the middle of the posterior margin. Above and behind this oblique line, some three, four, or more similar parallel, regularly disposed lines also extend from the back part of each beak to the posterior margin of the valves, thus marking off, as it were, a kind of corselet, somewhat similar to what we see in *Protocardia*, excepting that these radiating lines are scarcely visible to the unassisted eye and separated by spaces many times their own breadth. In the spaces between these posterior radiating lines the magnifier also shows numerous minute, raised granules, but these are much larger and more prominent than, and entirely distinct from, the extremely minute, crowded sculpturing seen by the aid of a higher magnifier over the whole of the surface. It is probably mainly due to the fact that the specimens have had the whole substance of the shell replaced by brilliant iron pyrites, that the delicate ornamentation mentioned has been preserved.

We know nothing of the nature of the hinge and interior of this beautiful shell, and consequently only place it provisionally in the genus *Schizodus*. We only know that other species found in our Coal-measures, agreeing apparently in their internal characters with *Schizodus*, show the same kind of very minute sculpturing seen on this. As some of these are very similar to the type on which Mr. Conrad proposed to found his genus *Prisconaia*, from the Coal-measures of Kansas, we requested him to examine his typical specimen to see if any traces of such minute surface markings could be seen on it by the aid of a strong magnifier, and he informed us that his shell shows the same sculpturing. As this marking is very peculiar, and entirely unlike any ornamentation we have ever seen on any other fossil, even in examples of various types in exactly the same state of preservation, it is not improbable that our shell will be found to possess the internal character of Mr. Conrad's type.

*Locality and position.* From the shales over the fifth coal bed of the Illinois Coal-measures, at Danville, of that State. For the use of the typical specimens we are under obligations to Dr. J. C. Winslow, of Danville.

#### Genus CLINOPISTHA, M. and W.

Shell transversely oval, very thin, rather ventricose, equivalve, very inequilateral; beaks near the posterior extremity and directed backward; that of the right valve with its immediate apex curving under the beak of the left, which seems to be a little excavated for the reception of the same; ligament external, short, rather prominent, and occupying an oval, or lance-oval shallow cavity, formed by the slight inflection of the margins of the valves immediately behind the beaks; valves with their margins smooth within and closed all around; hinge apparently edentulous; surface polished, and with merely fine lines or marks of growth, sometimes crossed by very faint traces of radiating lines, which are usually obsolete externally, but often seen on internal casts; muscular impressions shallow, those of the anterior side larger than the others and subquadrangular in form, with a faint oblique ridge along the upper margin; posterior muscular impressions oval and occupying somewhat flattened spaces near the truncated margin; pallial line faintly marked and simple.

Although we have not seen very clearly the hinge of this shell, we have been able, from impressions of it in the matrix, to be satisfied that it is not crenated, as in the *Nuculidæ* and *Arcidæ*; and we believe it to be entirely edentulous. In regard to the affinities of this type, however, we are left in doubt. In its thinness, and the posterior position of its beaks, as well as in the form and general appearance of its muscular and pallial impressions, and its apparent edentulous hinge, it reminds one of *Solenomya*. It differs, however, from that genus, remarkably, in its short gibbous form, rather ventricose beaks, and general physiognomy, as well as in wanting the internal ridge extending downward from the beaks, and apparently the partly internal liga-  
1870.]

ment. It likewise differs from the existing species of *Solenomya* in having the valves neatly closed all around, and the beak of its right valve curving under that of the left. In this latter character, however, it agrees with the carboniferous species of the West that have been referred to *Solenomya*, all of which have the point of the right beak passing under that of the left and Prof. McCoy has noticed this character in British carboniferous species. These carboniferous species, however, agree almost exactly in all their other known characters with recent typical species of *Solenomya*, even to the general form and the presence of an internal ridge under each beak, and differ as widely from our shell in all respects, excepting in the one character of the slight inequality of the beaks as the recent species of *Solenomya* do.

We are aware that Prof. King proposed to found a genus *Janeya* for the reception of the carboniferous and permian forms usually referred to *Solenomya*, and afterwards abandoned it, after farther comparisons with recent species. As he makes no allusion to the inequality of the beaks, it is probable he had no specimens of the fossil species with the two valves united. From this character, and the greater excavation for the internal part of the cartilage under and extending a little in advance of the beaks, in the Western carboniferous species referred to *Solenomya*, that we have had an opportunity to examine, we think it not improbable that the name *Janeya* may yet have to be retained for the carboniferous and permian species, at least in a subgeneric sense. Even in this case, however, it would still be necessary to establish a new genus for our shell, in consequence of the differences already noted, which separate it nearly as widely from the forms for which *Janeya* were proposed as from the recent *Solenomya*.

It is proper to remark here, that some able conchologists, to whom we showed specimens of the form under consideration, did not think it related to *Solenomya*, as typified by the recent species, but more nearly allied to the *Anatinidae*. As none of the numerous specimens of internal casts we have had an opportunity to examine, however, showed any indications of a cavity or process for the reception or attachment of an internal cartilage, as we see in that family, and the pallial line has no traces of the sinus usually (though not always) seen in the same, its relations to the *Anatinidae* seem to us doubtful.

CLINOPISTHA RADIATA, var. LEVIS.

*Edmondia ? radiata*, Hall, (?) 1858. Iowa Geological Report, Vol. 1, part 2, Palæont., p. 716, pl. 29, fig. 3.

Shell oval approaching oblong, the height being from two-thirds to three-fourths the length, moderately convex in young examples, and becoming ventricose with age; anterior side much longer and wider than the other, regularly rounded in outline, posterior side very short, rather narrow below the beaks, and vertically truncated, ventral margin most convex a little in advance of the middle, thence round upward into the front, while behind the middle, or nearly under the beaks, it is slightly contracted, or sinuous. Dorsal outline subparallel to the base, the margins of the valves being erect anteriorly and rounding into the anterior margin, hinge line rather short, beak rather ventricose, rising above the hinge line and placed about half way between the middle and the posterior end, posterior umbonal slopes often rendered somewhat prominently rounded by a slight flattening of the valve behind the beaks, near the truncated margin; ligament lance-oval in form, rather short, and placed immediately behind the beaks, exactly in the position we would expect to see the lunule if the shorter side of the valves were the anterior. Surface with a polished appearance, and generally only showing fine lines of growth, but in some examples also having obscure radiating marks near the ventral margin, which are nearly always defined on internal casts.

Length of a large specimen, 1 inch; height, 0.63 inch; convexity 0.4 inch.

[April

A careful examination of the typical specimen (now before us) of *Edmondia? radiata*, of the Iowa Report, cited above, has clearly satisfied us that it has the ligament on the short side, and certainly belongs to the genus we have here described, and we can scarcely doubt that it is really the same species as our type. As none of our numerous specimens, however, show the radiating markings so distinctly as that described by Prof. Hall, we have concluded to view them as belonging to a smooth variety, which we propose to designate under the name *levis*.

*Locality and position.* Near base of Coal-measures, Seaville county, Illinois. Prof. Hall's specimen came from the upper beds of the Coal-measures at Grayville, Illinois.

## GASTEROPODA.

### DENTALIUM ANNULOSTRIATUM, M. and W.

Shell very small, rather distinctly tapering and slightly arched; aperture and section circular; surface ornamented by regular, distinct, annular costæ, which pass around a little obliquely and are separated by rounded furrows of the same breadth as the costæ themselves.

Length of a specimen incomplete at both ends, 0.28 inch; diam. at the larger end, 0.06 inch; do. at the smaller end, 0.04 inch.

Of this delicate little shell we have seen but a single specimen, which is imperfect at both ends. At a first glance, it might be mistaken for another more common species, of near the same size, occurring at the same locality, and which we are inclined to think is the *D. Meekianum* of Geinitz. On examining it under a magnifier, however, it can be at once distinguished by its comparatively strong, regular costæ, instead of mere microscopic lines of growth.

It is with some doubt that we have referred this little shell to the genus *Dentalium*, because its small size and comparatively strong, regular costæ give it much the appearance of the non-spiral part of the shell of a *Cæcum*. It is more arched, however, and more tapering than we generally see in the body part of shells of that genus, which are likewise, we believe, unknown in any of the Palæozoic rocks.

*Locality and position.* Shales over the Danville Coal, holding a position about the horizon of the fifth Coal of the Illinois; or, near the upper part of the lower Coal-measures.

### STRAPAROLLUS (EUOMPHALUS) PERNODOSUS, M. and W.

Shell attaining a rather large size, subdiscoidal, or with the spire nearly on a plane with the upper outer edge of the body volution; umbilicus broad, moderately deep, and showing all the inner turns; volutions about five and a half, flattened-convex, and a little oblique on the broad periphery, but distinctly carinated near the outer side above (the carina being rugose), while a little outside of the middle below, they are prominent and ornamented by a row of moderately distinct nodes, of which about sixteen may be counted on the last turn; those on the last half of the outer volution becoming nearly or quite obsolete toward the aperture. Upper side of each whorl flattened and sloping distinctly inward from the carina to the suture; lower side of same sloping rapidly inward and slightly concave just within the prominent nodose ridge, and then rounding rather abruptly into the umbilicus. Surface marked by distinct lines, and at some places ridges, of growth; on the upper side of the whorls these lines pass obliquely outward and forward from the suture to the carina, thence obliquely backward in crossing the periphery; while in crossing the under side they curve a little backward.

Greatest breadth of a specimen not quite complete at the aperture, 2.50 inches; height at the aperture, about 0.84 inch.

1870.]

This species is evidently closely allied to *E. nodosus*, of Sowerby, from the Mountain Limestone of England. It may be distinguished, however, by its much less convex periphery, and by having its carina on the upper side of the outer whorl, nearer the outer side, as well as more rugose from an apparent effort to form irregular nodes. The true nodes around the prominent portion of its under side are more numerous than in *E. nodosus* (which has ten instead of fourteen to each whorl), and differ in being more irregular and nearly obsolete on the last half of the outer whorl.

Even if Montfort's name, *Stropharionus*, must be adopted for this genus, we think Sowerby's name, *Euomphalus*, should be retained in a subgeneric name for these planorbicular species with angular whorls, such as *E. pentagonalis*, for which it was at first proposed.

*Locality and position.* Atton, Ill. Lower Coal-measures.

**STROPHARIONUS (EUOMPHALUS) SUBQUADRATUS, M and W.**

Shell attaining nearly a medium size, discoid or subplanorbicular, concave and showing all the whorls both above and below, though the concavity is deeper below than above. Periphery nearly flat rather broad, and generally more or less oblique, with a distinct carina at the upper and lower edges, the former of which is more acute than the other, and irregularly crenate, sub-nodose, and projecting nearly upward, while the lower one is a little rounded and projects outward. Volutions five or six, not embracing, nor coiled exactly in the same plane on the upper surface, each sloping, with a slight concavity, distinctly inward from the marginal carina to the suture, while the flattened outer side usually has an obscure longitudinal sulcus near the upper and lower angles, the upper one being a little deeper than the other. On the under side the whorls slope gently inward from the marginal angle, so as to form a broad, depressed-subconical umbilicus. Surface marked with rather strongly defined lines of growth, which, at places, become subimbricating or form little irregular ridges. In crossing the upper side of the whorls, these lines start, at first, nearly at right angles out from the suture, but curve a little backward as they approach the marginal angle, and immediately after crossing this angle, and passing downward upon the nearly vertically flattened periphery, they are deflected a little forward, but soon after pass straight down to, and over the lower marginal angle to the under side, where they extend obliquely backward and inward, with a rather distinct curve, to the immediate vicinity of the suture, and then curve a little forward. Aperture and section of interior of whorls subcircular, or transversely oval.

Greatest breadth of a specimen with apparently about one-third of the outer volution broken away, 1.25 inches; height, 0.50 inch. When entire, this specimen was probably not less than 1.43 inches in breadth.

From the foregoing description, it will be seen that this shell is nearly allied to the common western Coal Measure species figured and described by Prof. Hall, in his Jour. Geological Report, under the name *Euomphalus rugosus* (see *E. rugosus*, Sowerby\*). Indeed, it is so nearly like that species that we at one time suspected that it might be only a gigantic and more ventricose variety of the same. Yet on comparing our shell with an extensive series of good specimens of *E. rugosus*, Hall, it is found to be greatly larger than any known authentic examples of that shell, its breadth being a little more than twice and a half that of the usual mature examples of *E. rugosus*. Its umbilicus and the concavity of its upper side, are also proportionally deeper, particularly the former, while the flattened outer side of its whorls is broader, and generally less oblique. Its lines of growth also differ in being rather distinctly deflected backward at the marginal angle of the upper side, so as to indicate an obscure sinus of the margin of the lip at the termination of this angle though

\* If Sowerby's species is really congeneric, the American form called *E. rugosus* by Prof. Hall might be distinguished by the specific name *subrugosus*.

there are no traces of a band, as in *Pleurotomaria*. This character would probably place the species in the group for which the name *Schizostoma* was proposed by Bronn, but palæontologists have generally regarded the type for which that name was proposed, as not being sufficiently distinct from *Euomphalus* to be retained as a separate genus.

Associated with the above, a single specimen was found, of the same size, and agreeing very closely with that from which the foregoing description was drawn up, but differing in being proportionally wider, and not so oblique on the periphery, which is also more convex in the middle. The angle of its under side also differs in being a little farther in from the outer margin, and directed downward, instead of outward, while its umbilicus is proportionally deeper. This may be a distinct species, but without more specimens for comparison we do not feel willing to regard it as being entitled to a separate name.

These shells, including *E. rugosus*, Hall, and *E. catilloides*, Conrad (sp.), are related to *E. quadratus* of McCoy, from the Mountain Limestone of Ireland, though sufficiently distinct specifically. At one time we were inclined to think that *E. rugosus*, Hall, and *E. catilloides*, Conrad, together with a few others, should be separated from *Euomphalus*, under a distinct generic name; but after seeing the large species we have here described, which so closely connect these little shells with such forms as *E. pentangulatus* and *E. catillus*, upon which the genus was originally founded, we can no longer doubt that all of these shells really belong to one genus. This series of intermediate forms connecting the small, nearly planorbicular species mentioned above with the typical forms of *Euomphalus*, shows clearly that none of the former belong to the articulate genus *Spirorbis*, as has been thought by some, but that they are really true mollusks.

*Locality and position.* Upper Coal Measures, Montgomery County, Illinois. Collected by Mr. G. C. Broadhead, of the Illinois Geological Survey.

#### SUBULITES INFLATUS, M. and W.

Shell very ventricose, subfusiform; volutions about five and a half to six, those of the spire moderately convex in the (external?) cast; last one very large, ventricose, and composing much the larger part of the whole, produced and contracted below so as apparently to terminate in a short canal; aperture narrow, rhombic and pointed, or angular above and below; suture well defined in the cast; surface unknown.

Height of a specimen with apparently about two whorls at the apex, and portions of the lower extremity of the produced body whorl broken away, 1.85 inches; breadth of body volution, about 1.15 inches.

It is barely possible that this may be a ventricose, fusiform *Murchisonia*, as we only know it from rough casts, apparently of the exterior. As it shows no traces, however, of any revolving band or line, and has much the general physiognomy of *Subulites*, we have concluded to refer it provisionally to that group.

Its most marked character is the large size and very ventricose form of its body volution, in which it resembles some of the Carboniferous species of *Macrocheilus*. It differs from these, however, in the produced and subcanaliculate peculiarity of the lower part of its body whorl.

*Locality and position.* Galena beds of the Lower Silurian: Carrol County, Illinois.

### CEPHALOPODA.

Genus NAUTILUS, Auct.

Subgenus SOLENOCHILUS,\* M. and W.

We propose the above name for a group of *Nautili* which we believe to be

---

\* σολήν, a channel; χεῖλος, lip.

the same as *Cryptoceras* of D'Orbigny, published in 1850. This change of name becomes necessary, however, because Dr. Barrande had used the name *Cryptoceras* for another widely distinct group of *Cephalopoda* in 1846. It is true he has since changed the name of his genus to *Ascoceras*, for the reason that Latreille had applied the name *Cryptoceras* to a genus of *Hymenoptera*. But if Latreille's name *Cryptoceras* is not considered sufficiently distinct on account of its different termination, from *Cryptoceras* (which we should think is the case), it would for the same reason, of course, be equally necessary to change the name of D'Orbigny's group. On the other hand, if we regard Latreille's name as being distinct enough to permit D'Orbigny's name to stand also or if Latreille's genus is not a valid one, in either case Dr. Barrande's original name *Cryptoceras* would have to be retained for his genus, and as it has priority of date, it would still become necessary to find another name for the group described by D'Orbigny.

The type of D'Orbigny's group was *Nautilus dorsalis* of Phillips, only known, we believe, from a mere fragment, showing the siphuncle to be marginal or on the outer side of the curve, as in *Ammonites*.\* In this country we already know several Carboniferous species that agree with D'Orbigny's type in the character or position of the siphuncle, and we find in all of these another remarkable peculiarity of the lip on each side. That is, it is drawn so as to form a kind of little canal, or spout-like channel, much as we see in *Argonauta gondola*, Adams. A good example of one of these shells is figured and described by Dr. White and Prof. St. John, under the name *Nautilus (Cryptoceras) Springeri*, in vol. i, p. 124, of the Transactions of the Chicago Academy of Sciences for 1867, and this may be regarded as the type of the group. It also includes our *N. (Cryptoceras) Leidyi*, *N. (Cryptoceras) capax*, and the species described below, with possibly our *N. (Cryptoceras) Rockfordensis*.

The mere fact that these shells have the siphuncle marginal, as in *Ammonites*, would perhaps not alone be a sufficient reason for placing them in a separate group from the typical *Nautilus*, since the siphuncle occupies various positions in the different fossil species of the latter. But when we take into consideration the additional fact that the marginal position of the siphuncle in these shells is always accompanied by the peculiar character of the lip we have described, it becomes of more importance.

#### NAUTILUS (SOLENOCHILUS) COLLECTUS, M. and W.

Shell thin, attaining a moderate size, slightly compressed or subglobose in general form; umbilicus rather small, but deep, perforated, and provided with very abrupt walls, particularly near the aperture. Volutions about one and a half increasing rapidly in size, and a little wider transversely than their dorso-ventral diameter, moderately embracing, with a subquadrate general section, the angles being rounded, and the lateral and outer or ventral surface more or less flattened. Septa moderately concave, distant about one-fourth the transverse diameter of the volutions at the point of measurement and showing a slight backward curve in crossing the sides and periphery; aperture large, and, as near as can be determined from the specimens, with a subquadrate or subcircular outline, more or less sinuous on the inner side for the reception of the small inner torn; siphuncle small. Surface smooth or only showing small lines of growth.

Greatest diameter of a small specimen, with body chamber broken away 1.70 inch; transverse diameter of same, about 1.25 inch.

As in other species of this group, the small siphuncle is so very nearly in contact with the ventral, or outer side, that in casts with the shell removed it often gives the appearance of a very narrow, deep lobe along the middle of that side. It is easy to see, however, that this appearance is merely produced

\* M. Chenu figures on p. 72, vol. i, of his *Manual of Conchology*, under the name *Cryptoceras Bowerbankii*, Sowerby, a shell certainly not belonging to D'Orbigny's group as he understood it, but, if correctly figured, belonging to the *Ammonitidae*.

by the breaking away of a thin part of the matrix between the siphuncle and the outer shell. None of our specimens are in a condition to show the margins of the lip, but some of them show very clearly the commencement of the protuberance, or pinching up of the margin on each side near the umbilicus, evidently terminating at the aperture in the usual spout-like auricles. The lines of growth also show the same, by their flexures on each side.

Specifically this shell is probably most nearly allied to our *N. (Solenochilus) Leidyi*, from the Keokuk division of the Lower Carboniferous, though it differs in having more rapidly expanding and subquadrangular whorls, which are also slightly embracing at the aperture, instead of being merely in contact. Its volutions, however, are much less rapidly expanding than in our *N. (Sol.) espar*, or in *N. Springeri* of White and St. John, as well as different from both in their subquadrangular form.

*Locality and position.* New Providence, Indiana, from a limestone of the age of the St. Louis division of the Lower Carboniferous.

#### Subgenus TEMNOCHILUS, McCoy.

##### NAUTILUS (TEMNOCHILUS) LATUS, M. and W.

Comp. *N. nodocarinatus*, M'Chesney, 1865. Illustrations Palæozoic Fossils, pl. 3, fig. 6 (5 by error, in explanations of plate.) Not *N. nodocarinatus* of same author in text of same paper (1860) p. 66.

The only specimen of this fine species we have ever seen consists of about half of one volution, which, being without septa, must belong to the part composing the last or body chamber, originally occupied by the body of the animal. It is broken at both ends, and measures around the curve of the outer side, 8.50 inches, with, at the larger end, a dorso-ventral diameter of 2.10 inches, and a transverse diameter (including the nodes) of 3.60 inches. The dorso-ventral diameter at the smaller end is about 1.60 inches, and the transverse about 2.40 inches. A section of the body volution is transversely subelliptical, with a tendency to an oblong outline; the outer (often called the dorsal) side of the whorl being very broad and flattened convex, and each lateral margin, exclusive of the nodes, being rather narrowly rounded, or a little flattened, while the inner side is a little concave. The broad flattened outer side has two very obscure longitudinal ridges, with a distinctly flattened space between. Along each (so-called) dorso-lateral margin there is a row of prominent flattened nodes, arranged at intervals of about their own greater (antero-posterior) diameter. About sixteen of these nodes occupied each side of the outer or last volution. The inner side of the whorl rounds regularly into the umbilicus, which appears to be wider than the dorso-ventral diameter of the volution at the aperture. The surface is without longitudinal lines, but the striæ of growth are moderately distinct, especially on the broad flattened outer side, where they make a deep backward curve in crossing, so as to indicate the presence of a very deep sinus in the lip on that side of the aperture of the shell.

In the specimen described, the substance of the shell is thin, and scarcely mineralized, though it retains no pearly lustre.

This species resembles very closely the form figured by Prof. McChesney in the memoir cited at the head of the foregoing description, and referred by him (by mistake) in the explanations of his plates, to his *N. nodocarinatus*.

Our shell differs, however, in not having so many nodes, as well as in having a proportionally wider umbilicus, and particularly in having the sides of its whorls rounding regularly into the umbilicus, instead of being subcarinate around its margins.

*Locality and position.* Carbon Cliff Mines, Rock Island County, Illinois. Lower Coal-Measures.

## NAUTILUS (TEMNOCHILUS) WINSLOWI, M. and W.

Shell attaining a moderately large size, subdiscoidal, periphery broad and nearly flat, the middle third being rather distinctly flattened, while on each side of this there is a very slight slope outward to the lateral margins. Umbilicus broad, moderately deep, and showing nearly the full breadth of each inner volution on each side. Volutions apparently about four and a half, with transverse diameter nearly one-third greater than the dorso-ventral. Each ornamented around the lateral margins of the broad periphery by about sixteen very prominent, rounded nodes which project obliquely outward, at an angle about intermediate between the general plane of the shell and that of the broad periphery, those on opposite sides being alternately arranged. From these rows of nodes the sides slope abruptly inward, with a moderate convexity, to their inner margins within the umbilicus. Surface marked by rather well defined lines of growth, which curve gently backward in crossing the sides of the whorls from the inner margin, and make a stronger backward curve in crossing the periphery, so as to indicate the presence of a rounded sinus in the outer margin of the l.p. (Siphuncle and septa unknown).

Greatest breadth of a specimen with a part of the outer volution broken away, 4.60 inches, transverse diameter of outer turn measuring across periphery without including the nodes, 2.46 inches (d). including the nodes, 2.95 inches. dorso-ventral diameter of the outer volution, 1.56 inches.

This species is evidently closely allied to the last, in form and general appearance, but differs in having its volutions proportionally narrower and lying at right angles to the plane of the shell. Its most marked difference, however, consists in the form of its nodes, which are round, instead of being distinctly compressed. It seems to be also related to *N. tuberculatus* of S. Derby, but differs from the published figures of that species in having its periphery proportionally broader, and distinctly more flattened, while its nodes are placed nearer the outer margin of the whorls, as well as more prominent. From *N. Occidentalis*, Swallow, (= *N. quadrangularis*, McCheyney), it will be readily distinguished by the greater transverse diameter of its whorls, which are also without the flattened sides of that species, and differ in wanting two mesial rows of nodes on the periphery.

This specific name of this fine *Nautilus* is given in honor of Dr. J. C. Winslow, of Danville, Illinois, to whom we are indebted for the use of the specimen from which the description was drawn up.

*Locality and position.* Danville, Illinois, from the shale over the fifth bed of coal, of the corrected Illinois section; being near the horizon of the upper part of the Lower Coal-Measures.

## NAUTILUS (TEMNOCHILUS) COXANUS, M. and W.

Shell rather small, subdiscoidal, broadly rounded, or depressed round over the periphery, umbilicus wide, rather deep, perforated, and showing more than three-fourths of the dorso-ventral diameter of each inner turn. Volutions about two and a half to three, increasing gradually in size with transversely than dorso-ventrally, very slightly concave along the dorsal inner side for the reception of the periphery of each succeeding turn with more or less narrowly rounded (subangular in some small specimens) ornamented by about fifteen small nodes around the middle of each, from which point the inner side rounds very abruptly into the umbilicus. Septa separated, on the outer or ventral side, by space about one-fifth or one-sixth the transverse diameter of the volutions at the point of measurement, arching very slightly backward in crossing the periphery. Body chamber composing about half of the outer volution. Siphuncle small and situated subcentrally, or somewhat nearer the outer side. Surface ornamented with distinct, regular, longitudinal, raised lines, or small costae, narrower than

[A]

rounded furrows between ; those along the middle of the ventral or outer side being smaller and more crowded than those toward the lateral regions ; crossing these are numerous very fine, crowded striæ of growth, which curve strongly backward in passing over the periphery, parallel to the margin of the very profound sinus in the lip on the ventral side.\* Aperture transversely oval.

Greatest diameter of a mature specimen, 2.23 inches ; thickness, or transverse diameter, about one inch ; dorso-ventral diameter of last turn near aperture, 0.86 inch.

Among the specimens before us there seem to be two varieties, which may possibly prove to be specifically distinct. One of these, which we regard as the typical form of the species, has the periphery very depressed-convex, while in the other, this part is distinctly more convex or rounded. As they agree, however, apparently almost exactly in all other characters, and both forms vary somewhat in the convexity of the periphery, we are inclined to view this as merely a sexual difference. In the more convex forms the lateral nodes seem to be generally a little more inclined to become slightly elongated in the transverse direction of the whorls, though this character appears not to be entirely constant. In both forms the longitudinal or revolving surface ridges and furrows become nearly or quite obsolete, toward the aperture, on the outer volution.

Internal casts of this species seem to be almost exactly like specimens figured by European authorities under the name *N. tuberculatus*, Sowerby. As that species, however, attains a much larger size, and has, according to Prof. McCoy's description, a very large siphuncle, while none of the figures or descriptions of it we have seen either show or mention the distinct longitudinal, or revolving costæ, so well defined on the surface of our species, we can entertain no doubt in regard to its being clearly distinct. It is true the figures of *N. tuberculatus* alluded to all represent only internal casts, while the longitudinal markings mentioned on our shell are not seen on internal casts ; but it is scarcely possible that such markings would never have been observed, as impressions in the matrix, if not otherwise, had they existed in Sowerby's species.

This species is named in honor of Prof. E. T. Cox, State Geologist of Indiana.

*Locality and position.* Three miles west of New Providence, Indiana ; from a light gray, brittle limestone, of the age of the St. Louis division of the Lower Carboniferous.

#### LITUITES GRAFTONENSIS, M. and W.

Shell rather small, with isolated portion discoid, planorbicular, and slightly concave on both sides ; volutions four or more, slightly embracing, increasing very gradually in size, with transverse section nearly or quite circular, excepting the slight concavity on the inner side. Surface ornamented by numerous distinct, very regularly arranged costæ, which cross the sides of the volutions very obliquely backward from the inner side, curving strongly backward as they approach the periphery, and after crossing the middle of the same, again deflected forward as on the opposite side, thus indicating a profound sinus in the outer side of the lip ; the sinus being very narrow, but not exactly angular at its termination, and widening rapidly forward ; fine, somewhat imbricating striæ of growth also run parallel to the costæ. Septa apparently moderately distant and running nearly straight across the sides. Siphuncle and free part of the body chamber unknown.

Greatest diameter of the coiled part, 2.10 inches ; transverse diameter, 0.54 inch ; dorso-ventral diameter of outer turn, about 0.52 inch.

---

\* This would be the dorsal side according to the nomenclature in most general use.

As we have not seen the siphuncle, or the free part of the body chamber of this species it may, possibly, not be a true *Lituites*. Still, as there is no slightest appearance of any obliquity of the volutions, as in the genus *Trochoceras*, we have scarcely any doubt in regard to its being a true *Lituites*. Compared with *Lituites Marshi*, of Hall, (20th Ann. Rep. Regents Univ. N. Y. pl. 16, figs 6 and 7,) from the same horizon, at Kankakee in this State our species will be at once seen to differ in having its volutions more closely coiled together, much less rapidly increasing in size, and ornamented with smaller and much more closely arranged costæ. Its costæ also make a stronger or deeper backward curve in crossing the periphery, which is rounded instead of being flattened, as in the *Marshi*. In general appearance it is more like *L. (Trocholites) ammonius*, of Conrad, from the Lower Silurian though its costæ are much more oblique, and differ in being separated by rounded furrows quite as wide as the costæ themselves; while its surface shows no trace of the finer sculpturing seen on that shell.

*Locality and position.* Grafton, Illinois, from a very light drab magnesian limestone of the age of the New York Niagara group. Upper Silurian

## CRUSTACEA.

### PHILLIPSIA TUBERCULATA, M. and W.

Attaining a large size. Head and thorax unknown. Pygidium semicircular, the length being very nearly four-fifths the breadth, very convex, posterior margin obtusely rounded, lateral margins diverging rapidly forward, with convex outlines. Axial lobe well defined, obtuse, and rather prominent behind and gradually widening forward, with nearly straight sides, rather distinctly more elevated than the lateral lobes, which it nearly equals in breadth at the anterior end, as seen in a direct view from above, but one-fourth narrower than the latter, measuring over the curve of each, showing sixteen or seventeen straight, well defined segments, each of which is provided with six small tubercles, arranged so as to form six rows. Lateral lobes with about fourteen segments each, the very short posterior ones being nearly on a line with the axial lobe, while the others grow gradually more transverse anteriorly, so as to show only a moderate obliquity toward the front, all extending down so as to leave only a very narrow, undefined, smooth marginal space and each ornamented by from two or three to about twelve tubercles, the number increasing regularly with the length of the segments toward the anterior. Surface between the segments and tubercles smooth.

Length of pygidium, 0.95 inch; breadth, 1.45 inches; convexity, 0.40 inch.

This fine species resembles *P. ornatus*, Portlock, perhaps more nearly than any other, but it attains a larger size, and its pygidium is more broadly rounded behind, with its mesial lobe less rapidly tapering posteriorly, while the rows of tubercles on the segments of its lateral lobes are distinctly more numerous. In general outline, its pygidium more nearly resembles a form figured by Prof. de Koninck under the name *Phillipsia gemmatifera*, Phillips, (Ann. Mus. Foss., pl. III, fig. 4), though its axial lobe is distinctly narrower, while its lateral lobes are merely provided with tubercles, along the segments, instead of short spines.

*Locality and position.* Kinderhook, Pike County, Ill. Burlington division of the Lower Carboniferous.

### PHILLIPSIA (GRIFFITHIDES) BUFO, M. and W.

Entire outline elliptical, the breadth being to the length as 75 to 130. Cephalic shield forming more than a semi-circle, round in front and nearly straight behind; posterior lateral angles terminating in short, abruptly pointed spines extending back to the anterior edge of the third thoracic segment.

[Ap

Glabella rather depressed convex, wide anteriorly and narrowing posteriorly to the neck furrow, just in front of which, and connected with the palpebral lobes on each side, it has a single small, obscure lateral lobe; neck furrow broad, and well defined both across the glabella and across the posterior margins of the cheeks; neck segment rather wide, depressed below the level of the highest part of the glabella in front of it. Eyes of moderate size, reniform, nearly as prominent as the glabella, placed but little in front of the continuation of the neck furrow across the cheeks, apparently smooth, but showing, when the outer crust is removed, numerous very minute lenses beneath. Cheek sloping off rather abruptly from the eyes to the thickened margin, which does not continue around the front of the glabella; facial sutures cutting the anterior margin in front of the eyes before, and a little outside of them behind.

Thorax nearly twice as wide as long, distinctly trilobate; mesial lobe but moderately prominent, nearly twice as wide as either of the lateral lobes, its eight segments merely rounded and without furrows. Lateral lobes narrow; pleuræ curving moderately downwards at less than half their length out from the axial lobe, but not distinctly geniculated, each provided with a furrow extending nearly half-way out. Pygidium approaching semi-circular, with the anterior lateral angles obliquely truncated; mesial lobe but slightly wider anteriorly than the lateral; segments about eleven; lateral lobes with eight or nine segments.

Surface finely granular, the granules being most distinct on the glabella, and the segments of the mesial lobe of the thorax.

This species will be at once distinguished from our *P. Portlockii*, from the same horizon, by its much broader and less ventricose glabella, and the peculiar tuberculiform eyes of that species, as well as by the broader and less prominent mesial lobe of the pygidium, in the form under consideration.

*Locality and position.* Crawfordsville, Indiana. Keokuk division of the lower Carboniferous series.

#### ASAPHUS (ISOTELUS) VIGILANS, M. and W.

Body small, elliptic in general form, and moderately convex. Head rather more than half as long as wide, approaching a subcrescentic outline, with the posterior lateral angles abruptly rounded or subangular; anterior margin apparently somewhat narrowly rounded; posterior outline broadly and distinctly concave, but rather straight along the middle, without any traces of marginal or occipital furrows. Glabella not rising above the general convexity of the head, and entirely undefined by any traces of dorsal furrows. Eyes situated about their own antero-posterior diameter in advance of the posterior margin, and apparently about half way between the latter and the front, rather widely separated from each other, and very prominent, nearly round, and truncato-sub-conic in form; visual surface elevated almost entirely above the general convexity, and curved around so as to form about three-fourths of a circle, presenting a smooth surface; palpebral lobes as elevated as the eyes, and much contracted, or merely connected with the glabella on the inner side by a narrow neck. Facial sutures extending obliquely outward and backward from the eyes behind, so as to intersect the posterior margin about half-way between a line drawn longitudinally through the middle of each eye, and the posterior lateral margins of the cheeks; and in front, at first curving slightly outward a little in advance of each eye, beyond which point they converge forward so as apparently to intersect the front margin in such a manner as to leave a rather narrow anterior edge to the glabella.\*

Thorax longer than the head or pygidium, as measured over the curve of a

---

\* As the specimen is imperfect here, it is possible these sutures may not reach the anterior margin in front.

rolled-up specimen, showing scarcely any traces of trilobation, and composed of eight segments. Mesial lobe, as indicated by very faint impression on each side of the body segment, very wide and depressed, with segments nearly flat. Lateral lobes very narrow, sloping off regularly from the mesial one on each side, pleurae without furrows, and with the exposed surfaces seen in a rolled-up specimen, narrowing off laterally very rapidly, with a strong backward curve, all more or less angular at the extremity, the posterior ones being rather pointed, lapping surfaces apparently wide.

Pygidium subtriangular and of near the same size as the head, entirely without any indications of trilobation or segments.

Whole surface smooth, excepting a minute pitting, most distinct on the movable cheeks.

Length measuring over the curve of the specimen as rolled together .8 inches; breadth, 1.39 inch, length of head at the middle, about 0.75 inch, breadth between the eyes, 0.47 inch, height of eyes on the outer side .1 inch. Breadth of axial lobe of thorax 0.85 inch, antero-posterior diameter of each of the first four or five segments of same near middle, 0.15 inch.

This species seems not to be nearly related to any of the described forms with which we are acquainted. Its most marked characters are the prominence of its eyes, and the almost entire absence of any traces of trilobation on its thorax and pygidium, as well as the great breadth of the mesial lobe of the same, as indicated by a very obscure depression, and a minute projection on the anterior margin of each thoracic segment, on a line nearly behind the outer edge of each eye. These little projections do not extend upward but forward, and fit into corresponding notches in the posterior margin of each succeeding segment in front. As the anterior margin of its head and the posterior edge of its pygidium are in the specimens more or less imperfect, we cannot determine exactly their outlines.

In some respects this species resembles young individuals of *Isotelus meyeri* of Lock, though it differs in not having its cheeks produced into pointed terminations behind, while its eyes are more prominent and situated farther forward, and the mesial lobes of its thorax much less defined and distance wider. Its pleurae also differ in being angular or a little pointed, instead of rounded at the ends.

*Locality and position.* Carroll County and Osage County, Illinois. Cincinnati group of the Lower Silurian.

#### ILLÆNUS (BOMASTUS) GRAFTONENSIS, M. and W.

Attaining a rather large size. Head (as determined from internal cast) transversely subelliptic, as seen from above, when placed with the under side on a horizontal plane, its breadth being to its length very nearly as 50 to 55, moderately convex, the height being rather distinctly less than half its breadth, and the most prominent part a little behind the middle, while it curves over the middle, from its posterior to its anterior margin, forms about a quarter of a circle. Anterior margin, as seen from above, presenting a nearly transverse semi-elliptic curve, and a subrectangular outline as seen in side view, lateral margins rather narrowly and regularly rounded in outline into the posterior side. Axial furrows distinct, converging forward to a point nearly opposite the middle of each eye, where they terminate in little flattened oval impressions. Eyes large, forming nearly semi-circular curves with the posterior ends as near the posterior as to the lateral margins of the head, each with a broad, very deep, rounded furrow around beneath its outer side so as to form a kind of obtuse shoulder below, from which the cheeks drop nearly vertically, with a slight convexity of outline to the inferior margin, palpebral lobes less elevated than the middle of the glabella, and sloping a little outward, with an even convexity over their whole surface, visual surface forming rather narrow convex bands, and showing (in the internal cast) as

[Ap

magnifier numerous very minute reticulations. Facial sutures cutting the anterior margin distinctly within a line drawn antero-posteriorly through the inner ends of each eye, and intersecting the posterior margin nearly on a line with the middle of each eye. Rostral shield flat, with a subfusiform outline and obtuse lateral extremities; just three times as wide as its antero-posterior diameter. Surface of the internal cast of the whole upper part of the head without lines or furrows, but rather distinct transverse furrows are seen on the rostral shield. (Body and other parts unknown.)

Length of head, about 1.20 inches; breadth of do., 2.47 inches; height or convexity, 1.05 inch. Length of eyes, 0.55 inch; height of visual surface of same, 0.10 inch; distance between the eyes at posterior and anterior ends, 1.65 inch.

This fine species is perhaps most nearly allied to the common and widely distributed *I. Barriensis* of Murchison. It may be readily distinguished, however, by several important differences in the head, which is the only part yet known to us. In the first place, its head is much wider in proportion to its length, and has its lateral margins, as seen from above, much more narrowly and regularly rounded in outline, so that the cheeks do not project any farther out from the eyes posteriorly than laterally, the outline of the lateral margins having almost exactly the same curve as the eyes themselves. Its rostral shield also has a very different form from that of Murchison's species, being narrower in its antero-posterior diameter, and distinctly obtuse, instead of pointed, at the lateral extremities. Our species likewise shows no traces of the furrows on the cast of the upper side of the head, so strongly marked in *I. Barriensis*.

It is still more widely removed from *I. insignis* of Hall; and we know of no described species having the head so nearly elliptic in outline (transversely, as seen from above, excepting possibly *I. Salteri* of Barrande, which, however, differs widely in other characters, belonging, as it does, to the small-eyed section of the genus.

*Locality and position.* Grafton, Illinois, from the Niagara division of the Upper Silurian.

#### DITYROCARIS CARBONARIUS, M. and W.

We only know this fossil from a specimen showing the caudal appendages.—that is, the telson and stylets.\* These are lanceolate in general outline, and rather flattened. The telson seems to be a little shorter than the stylets, and more rapidly tapering toward the extremity. Below it is flat, and has a faint, undefined, obtuse longitudinal ridge along the middle, with on each side an equally undefined, shallow sulcus between this and the lateral margins, which are sharp. On its upper side there is a well defined mesial carina, with a slightly concave slope on each side to the lateral margins, thus presenting much the form of a broad bayonet. The stylets have each, on the flattened under side, about six or seven small longitudinal ridges, and on the upper side a distinct longitudinal mesial carina, between which and the lateral margins there is on each side a smooth rounded concavity or broad furrow; along each lateral margin there are two closely approximated carinae, one above, and one below with a narrow rounded sulcus between.

Length of telson, about 0.75 inch; breadth of do., 0.12 inch; length of stylets, about 0.80 inch; breadth of same near the articulating end, 0.12 inch.

This species will be readily distinguished from *D. Scouleri* of McCoy, by its proportionally broader and more lanceolate stylets and telson, the latter of which is also smooth instead of being marked by oblique divaricating striae, as

---

\* If the middle one of the three nearly equal caudal appendages in this genus is not articulated at its base, it would only be properly an attenuated terminal part of the telson, and not the whole of that segment.

in the *Semiferi*. Its stylets are also flattened and carinated, instead of being rounded. From Portlock's *C. Color* it will be distinguished by having the carinae of its stylets and telson smooth, instead of crenate.

So far as we are informed, this is the first species of this genus found in America. It is another decidedly Carboniferous genus, found in our Coal Measures, directly associated with numerous fossils that occur in the beds on the Missouri, in Nebraska, that have been wrongly referred by some authors to the Permian (*Dynas*).

*Locality and position.* Near the middle of the Coal Measures at Danville, Illinois, associated with numerous Upper Coal Measure species.

—

**Descriptions of FOSSILS collected by the U. S. Geological Survey under the charge of Clarence King, Esq.**

BY F. D. MEEK.

WASHINGTON CITY, March 21st, 1870.

PROF. JOSEPH LEIDY.

Dear Sir,—I send herewith, to be presented for publication in the Proceedings of the Academy, descriptions of a few of the fossils brought in by the United States Geological Survey under the direction of Clarence King, Esq. You will please state, in presenting the paper, that the Trilobites described in it from Eastern Nevada, are decidedly Primordial types, and, so far as I know, the first fossils of that age yet brought in from any locality west of the Black Hills. Mr. King's collections also establish the fact that the rich silver mines of the White Pine district occur in Devonian rocks, though the Carboniferous is also well developed there. The Devonian beds of that district yet known by their fossils, seem mainly to belong to the upper part of the system. Mr. King, however, has a few fossils from Pinon Station, Central Nevada, that appear to belong to the horizon of the Upper Helderberg limestone of the New York series.

The Tertiary fossils described in this paper, from the region of Hot Spring Mountain, Idaho, came from an extensive and interesting fresh-water Lacustrine deposit, and are all distinct specifically, and some generically, from all the other Tertiary fossils yet brought from the far west. Two of the species belong to the existing California genus *Carinifer*, or some closely allied group, while another beautifully sculptured species was thought, by Mr. Tryon, to whom I sent a specimen of it, to be possibly a true *Melania*, and allied to existing Asiatic forms.

It is an interesting fact, that among all of our fresh-water Tertiary shells from this distant internal part of the Continent, neither the beaks of the bivalves, nor the apices of the spire in the univalves, is ever in the slightest degree eroded; even the most delicate markings on these parts being perfectly preserved, if not broken by some accident. From this fact it may be inferred that the waters of the lakes and streams of this region, during the Tertiary epoch, were more or less alkaline, as in the case with many of those there at the present day.

These descriptions, as well as others that I expect to send you soon, are merely preliminary and will be re-written, and presented with full illustrations, now in course of preparation in Mr. King's report of his survey.

Length of largest specimen, 0·34 inch; height, 0·30 inch; convexity, 28 inch.

The most marked characteristics of this species, are its quadrato-suborbicular, rather gibbous form, very nearly central beaks, and particularly its sharply elevated concentric striæ, growing stronger, more prominent, and more distantly separated on the umbones, until near the points of the same they often assume the character of sharp, raised plications. In some of the smaller specimens, these raised, rather distantly separated, stronger striæ, extend over nearly the whole surface; while in others they pass gradually into mere irregular lines of growth, on most of the surface, occasionally separated by wider furrows.

In form this species is very similar to the existing *S. Vermontanum*, of Prime, with which it also agrees nearly in size. It is more regularly rounded in front, however, and has stouter lateral teeth; while its concentric raised striæ and sulcations are generally larger and grow more distinct on the umbones than below, instead of the reverse. In this latter character of marking it agrees more nearly with *S. aureum*, Prime, from which, however, it differs entirely in form.

*Locality and position.* Hot Spring Mountains, at Fossil Hill, Idaho Territory.

#### SPHÆRIUM? IDAHOENSE, Meek.

Shell attaining a very large size, moderately convex, rather thick in proportion to size; orbicular-subovate in outline, being wider in front than posteriorly; anterior margin regularly rounded; base semioval in outline; posterior margin somewhat narrowly rounded below and sloping forward above; dorsal margin short. Beaks placed in advance of the middle, a little compressed and directed obliquely forward and inward. Surface marked by concentric striæ and furrows. Lateral teeth stout.

Length, 0·98 inch; height, about 0·92 inch; convexity, about 0·54 inch.

The specimens of this shell are not in a very good state of preservation, being, with one exception, internal casts, and this one only retains a part of the shell. They certainly differ, however, from the last not only in their much larger size, but in being less nearly equilateral, more produced, and rather more narrowly rounded posteriorly, as well as proportionally less convex. The internal casts have the umbonal region, from a little above the middle of the valves, compressed. Some of these casts show a few rather distinct, broad, irregular concentric undulations, that were doubtless more strongly defined on the exterior of the valves.

None of the specimens of this shell show the hinge very clearly, but from its large size and thickness I was at first inclined to believe it a *Cyrena* or a *Corbicula*. Impressions in the matrix, however, show that its lateral teeth are not striated, nor of the form seen in the latter genus. Possibly, I should call it *Cyrena Idahoensis*. As its pallial line is certainly simple, however, and not sinuous, as in all the American living species, and, so far as known, in all the fossil *Cyrenas* and *Corbiculas* of this continent, I have concluded to place it provisionally in the genus *Sphærium*, until better specimens can be obtained for study.

*Locality and position.* Same as last, and from same formation at Castle Creek, Idaho.

#### ANCYLUS UNDULATUS, Meek.

Shell thin, attaining a very large size, elliptic-oval in outline, being sometimes slightly widest a little in advance of the middle; apex much elevated, pointed, curved backward and placed about half-way between the middle and the posterior margin; posterior slope concave; lateral slopes nearly straight; anterior slope distinctly convex. Surface marked with fine, rather obscure

1870.]

lines of growth, and strong, comparatively large concentric undulations, most distinct and regular on the anterior slope, where there are sometimes very obscure traces of about three radiating ridges.

Length of the largest specimen seen, 0.67 inch; breadth of do., 0.54 inch; height, 0.35 inch.

The specimens show some variation in their proportions, as well as in the regularity and distinctness of the undulations, the largest individual from which the above measurements were taken being proportionally a little wider and more elevated than some of the smaller ones, while its undulations are less distinctly and regularly defined. As there are various gradations, however, in these characters, I am at present inclined to regard them as mere individual modifications of one species.

Owing to the thinness of the shell, the undulations are often quite well defined on internal casts, particularly along the anterior slope.

The only N. American recent species, with which I am acquainted, that approaches this in size, is the *A. Newberryi*, described by Dr. Lea, from California. From this the species under consideration differs in having its apex nearer the posterior, and much more pointed and curved backward. The undulations of its anterior slopes also give the shell quite a different appearance.

*Locality and position.* Fossil Hill, Hot Spring Mountains, Idaho Territory.

#### MELANIA (GONIORASIS?) SCULPTILIS, Meek.

Shell of medium size, conoid-subovate; spire more or less elongate-conical, with convex slopes, the apical angle being greater in the young than in the adult, not eroded at the apex; volutions six to seven, rather distinctly convex; suture strongly channeled; aperture ovate, a little oblique, rather narrowly rounded below; lip sharp, most prominent below the middle, and slightly sinuous at the lower inner side. Surface elegantly ornamented by numerous very regularly disposed, slightly flexuous or sigmoid vertical costæ, which are crossed by equally distinct and regular spiral ridges, about four of which may be counted on each volution of the spire (excepting those near the apex, which are smooth), and eight to ten on the last turn, on the under half of which they are most strongly defined; minute lines of growth may also be seen by the aid of a magnifier; costæ slightly nodulous at the points where they are crossed by the little revolving ridges.

Length, 0.63 inch; breadth, 0.33 in.

This is a neat species, remarkable for its sharply defined and very regular concentric ornamentation. The volutions of the spire are well defined on all

a somewhat crenated appearance; lower half of last turn marked with a few distinct revolving raised lines.

Length, 0.43 inch; breadth, 0.19 inch; length of aperture, 0.14 inch; breadth of do., 0.10 inch.

This species may be at once distinguished from the last by its less convex whorls, and the absence of revolving ridges or lines, excepting on the lower part of the body volution, and the one just below and above the suture. As in the last, its apical whorls are smooth. The only good specimen of it seen is considerably smaller than the adult size of the last described species.

*Locality and position.* Same as last.

#### CARINIFEX BINNEYI, Meek.

Shell attaining a large size, depressed subglobose in form; spire scarcely rising above the body whorl; umbilicus large, but rapidly contracting within. Volutions about three and a half, increasing very rapidly in size; those of the spire a little convex, last one forming more than nine-tenths the entire bulk of the shell, widest above, and produced below so as to form a prominent ridge or subangular margin around the widely excavated umbilical region; all without revolving carinæ. Aperture large, obovate, being widest above and narrowed abruptly to a subangular termination below. Lip remarkably oblique, apparently reflexed and strongly produced forward above. Surface marked with extremely oblique lines of growth, which sometimes form little regular costæ.

Height, 0.59 inch; breadth, 1 inch; height of aperture, about 0.50 inch; breadth of do., 0.54 inch.

This species differs too widely in nearly all of its characters to require any comparison with *C. Newberryi*, the typical and only known living species, which it also exceeds in size.

All of the specimens of this species in the collection are incrustated by a laminated, smooth calcareous deposit, that has to be removed before the surface marking can be seen. This is continuous over the suture, and covers all the volutions of the spire. At first I was inclined to think this might have been secreted by the mantle of the animal enveloping the whole shell; but farther examinations have led me to think it more probably merely an inorganic incrustation, precipitated over the surface after the death of the animal. Named in honor of W. G. Binney, Esq.

*Locality and position.* Fossil Hill, Hotspring Mountains, Idaho Territory. Apparently of Miocene or later age.

#### CARINIFEX (VORTIFEX\*) TRYONI, Meek.

Shell depressed subglobose, approaching subdiscoidal, the spire being much depressed. Volutions four and a half to five, increasing rather rapidly in size; those of the spire slightly convex; last one sometimes becoming a little concave on the upper slope near the aperture, and more or less ventricose below, the most prominent part being near the rather small, deep umbilicus, into which it rounds abruptly; all rounded on the outer side, and without any traces of carinæ or revolving markings. Suture well defined. Aperture rather large, subcircular, its height being to its breadth about as 29 to 34; lip sharp, oblique, and produced forward above, faintly sinuous at the middle of the outer side as well as at the inner side of the base, where it is a little thicker. Surface ornamented with small, distinct, regular ridges, and much finer lines of growth running parallel to the very oblique outline of the lip.

Height, 0.35 inch; breadth, 0.64 inch; height of aperture, 0.29 inch; breadth of do., 0.34 inch.

This shell differs from the last, not only in its smaller size, more rounded, less rapidly enlarging whorls, and more prominent spire, but particularly in its very much less excavated umbilical region. It evidently varies consider-

---

\* I propose the subgeneric name *Vortifex* for these shells, which differ from the typical forms of *Carinifex*.

ably in form and surface markings, some of the specimens being proportionally more ventricose, or, in other words, have the body volution, and consequently the aperture, higher in proportion to breadth than the others, while more or less difference in the elevation or depression of the spire is observable. The most marked differences, however, are to be observed in the character of the surface markings. Generally the little regular costae parallel to the lines of growth are pretty well defined, but in some cases they fade away so as to be scarcely distinguishable from the fine incremental lines; while in others they are strongly marked, regularly disposed costae. Sometimes, different parts of the surface of the same individual specimen present the variation of sculpturing mentioned. It may be found convenient to designate the more ventricose form as variety *ventricosa*.

Named in honor of G. W. Tryon, Jr., of Philadelphia.

*Locality and position.* Same as last.

*CASINIFEX (TRYONI, var.) CONCAVA, Meek.*

The only two specimens of this form obtained are considerably smaller than the adult size of the last described species, and differ in having the spire so strongly depressed as to be really concave, and thus to give the entire shell a subplanorbicular outline. Its umbilicus is proportionally of about the same size, as in the *C. Tryoni*, and its two or three volutions, as in that form, are rounded and without carinae. Its aperture is more nearly circular, being about as wide as high, in consequence of the body volution being proportionally less prominent below. Its costae are very strongly defined and regularly disposed.

It seems improbable that this can be merely the young of *C. Tryoni*, because, of some forty odd specimens now before me, not one has the apex or first two volutions concave, though they vary somewhat in prominence in different individuals.

Height, 0.18 inch; breadth, 0.30 inch; height of aperture, 0.18 inch; breadth of do., 0.17 inch.

*Locality and position.* Same as foregoing.

*Devonian Species.*

*SPINIFEX (TRIGONOTRYETA) PINOCHENSIS, Meek.*

Shell attaining about a medium size, somewhat wider than long, varying from transversely subovate to a nearly semicircular general outline; rather gibbous in adult examples; cardinal margin nearly or quite equaling the greatest breadth, and terminating in rectangular or rather more obtuse extre-

Length of a medium sized specimen, 0.92 inch; breadth of do., 1.20 inch; convexity, 0.72 inch.

As nearly as can be determined from a description only, this shell would seem to be closely related to *S. macrothyris*, Hall, from the Upper Helderberg Limestone of New York and Ohio (see 10th Report Regents, p. 133), but differs in being always narrower in proportion to length, never being near "twice as broad as long." Its area also differs in narrowing regularly to the lateral extremities of the hinge, instead of having parallel margins. On comparison, with good specimens of *S. Oweni*, Hall, from the Upper Helderberg Limestone at the falls of the Ohio, which species our shell nearly resembles, it is found to differ in having the beak and area of its ventral valve always more strongly arched. Its area is also proportionally narrower, and its plications larger and less numerous. There are in the collection a large number of well preserved specimens, showing the characters given to be very constant.

*Locality and position.* Pinon Station, Nevada. Devonian, probably of the age of the Upper Helderberg Limestones of New York.

#### *Lower Silurian Species.*

##### EUOMPHALUS (RAPHISTOMA?) ROTULIFORMIS, Meek.

Shell small, sublenticular, or more than twice and a half as wide as high, with the periphery sharply angular, and the much depressed spire a little more prominent than the convexity of the last turn below the angular periphery; umbilicus very wide, deep, and depressed conical; volutions six or seven, exceedingly narrow, and increasing very gradually in size, all obliquely flattened, or sometimes slightly concave on the upper slope, which is nearly coincident with that of the spire, and with the under side sloping downward and inward, and nearly one-third wider than the upper surface to the umbilicus, around which they are rather distinctly angular; aperture obliquely rhombic. Surface unknown.

Breadth, 0.32 inch; height, 0.12 inch; breadth of last turn on the upper slope, 0.15 inch; do. on the under slope, 0.18 inch; breadth of aperture, 0.09 inch; height of do., 0.07 inch.

This species is evidently nearly allied to *Euomphalus polygyratus*, Roemer, from the Lower Silurian rocks of San Saba, Texas (see Kreid. Von Texas, tab. xi, fig. 4 a, b). It differs, however, in being much smaller, its greatest diameter being less than one-fourth that of Roemer's species, although it shows nearly the same number of volutions. Its volutions are also proportionally more convex below, and slope more abruptly into the umbilicus.

*Locality and position.* Ridge south of Muddy Creek, Nevada Territory, from a gray subcrystalline limestone of Lower Silurian age, probably of the same horizon as the Calciferous sand rock of the New York series.

##### EUOMPHALUS (RAPHISTOMA?) TROCHISCUS, Meek.

Shell sublenticular, about twice and a half as wide as high, spire much depressed, or but little higher, measuring from the horizon of the sharply angular periphery, than the convexity of the last turn below the same; umbilicus wide, deep and depressed conical; volutions four and a half to five, increasing gradually in size, all obliquely flattened (or sometimes slightly concave) above, nearly on a line with the slope of the spire, and sloping downward and inward below to the umbilicus, into which the curve is so abrupt as to form an obtuse angle around the same; aperture wider than high, and rhombic subtrigonal in outline. Surface unknown.

Breadth, 0.40 inch; height, 0.15 inch; breadth of last turn, 0.12 inch; breadth of umbilicus, about 0.25 inch.

This is similar in general appearance to the last species, but may be readily distinguished by its less numerous whorls, which increase more rapidly in 1870.]

size. It is much more nearly allied to a form now before me in masses of chert from the west side of Lake Pepin, in Minnesota, found in beds of about the age of the Calceiferous Sand rock of the New York series. The latter, however, attains a much larger size, some of the specimens being an inch in diameter, with about six volutions. The Minnesota form is also more sharply angular on the periphery, and has the upper side of the volutions distinctly more concave, and the spire more depressed.\*

*Locality and position, same as last.*

PARADOXIDES? NEVADENSIS, Meek.

The only specimen of this Trilobite obtained, consists of a natural and formed by a moderately thick crust of *Arragonite*, deposited in a mould or impression of a part of the thorax and the pygidium, with the free edges of the latter broken away. Its rather large size, much depressed form, spiniferous pleuræ, and general physiognomy, as far as seen, at once recall to the mind the well known genus *Paradoxides*. A closer inspection, however, shows its pygidium to be proportionally larger than we see in the known species of that genus, with possibly the exception of *P. Forchhammeri*, of Angeln.

Of the thorax, eight of the posterior segments are preserved. These show the axial lobe to be much depressed, and about as wide as the lateral ones exclusive of the free recurved points of the pleuræ. The segments of the axial lobe are defined by a broad rounded furrow or depression across the anterior side of each, and have much the general appearance of those of some species of *Paradoxides*, being a little thickened, squarely truncated, and slightly curved forward at the ends. But they differ in showing distinct remains of a mesial spine or tubercle on each, and in having an obscure, oblique furrow or depression on each side, passing outward and backward from the broad anterior transverse furrow to the posterior lateral angles, so as partly to isolate the slightly thickened and truncated extremities of each. The lateral lobes are nearly flat, and composed of pleuræ that extend straight outward at right angles to the axis, to their free extremities, which are abruptly contracted (almost entirely on the posterior side) into slender, rounded or sharp spines, which curve backward and outward. Each of the pleuræ is also provided with a broad, rather deep, flattened furrow, which commences near the inner end, and extends straight outward for some distance, with parallel sides but gradually tapers, mainly on the anterior side, to a lanceolate point before reaching the free extremities. These furrows have not the parallelism usually seen in those of *Paradoxides*, but run parallel to the direction of the pleuræ, so as to leave slender straight ridges, of equal size, along the anterior and posterior margin of each rib.

The pygidium, exclusive of the portions of the free border broken away by a nearly semicircular outline, being about twice as wide as long, while it is much flattened as the thorax. The part remaining equals in length the five thoracic segments next in advance of it. Its mesial lobe is much depressed and about three-fourths as wide, anteriorly, as the breadth of that of the thorax at its widest part seen. Posteriorly it tapers very little, and extends nearly the entire length of the pygidium, as seen with the free border broken away. It is evident, however, that the flattened border projected more or less behind its termination. It shows distinctly five segments, with inclinations of about two others at the posterior end. The lateral lobes have each three segments, the anterior one being extended out nearly parallel to those of the thorax, while the others are directed more obliquely backward, and rapidly widen outward. Like the pleuræ, they have each a broad flattened furrow, that of the anterior one being nearly parallel to those of the pleuræ.

\* This Minnesota shell probably belongs to an undescribed species, as it has more volutions than the form described by Dr. Owen, under the name *Stropharolites* (*Euomphalus*) *nevadensis*. (See his large Geological Report of 1852, p. 581, pl. 11, fig. 12 and 13. It might be called *Euomphalus Pepinensis*.)

while those of the other two are directed more obliquely backward, particularly the posterior one, which is almost parallel to the longitudinal axis of the body. These furrows are so deep and broad as to give the three segments of each lateral lobe the appearance of six irregular ridges, the irregularity being produced by the posterior two segments instead of passing along the middle of each segment, being curved backward so as to divide these segments very unequally, leaving the anterior part much broadest. No fine surface markings are preserved on the specimen.

Entire length of the imperfect specimen, 2.75 inches, of which remaining 8 thoracic segments form 1.70 inch; breadth of the thorax, exclusive of the free spiniferous ends of the pleuræ, 2.05 inches, and including the projecting ends of the pleuræ, 2.40 inches; length of what remains of the pygidium, 1.03 inch; breadth of do., about 1.80 inch. Supposing it to be a true *Paradoxides*, with not less than sixteen thoracic segments, the entire specimen, when complete, could not have been far from six inches in length.

It is possible I should call this species *Olenus* or *Conocoryphe Nevadensis*, but its large size seems to be an objection to placing it in any section of either of these genera. In the possession of a node or spine on each of the thoracic segments, as well as in the direction of the posterior segments of the lateral lobes of the pygidium, it agrees with the type of *Parabolina*, but unfortunately the specimen is not in a condition to show whether or not these segments of the pygidium terminated in produced marginal spines, while the furrows of its pleura have not the obliquity of those seen in that type, but agree more nearly with those of some species of *Conocephalites*. The comparatively large size of its pygidium, and the nodes or spines on its thoracic segments, as well as the nature of the furrows of the pleuræ, are rather against its reference to *Paradoxides*, and lead me to think that it may belong to an undescribed genus.

#### CONOCORYPHE (CONOCEPHALITES) KINGII, Meek.

Entire form ovate, and much depressed, with breadth equaling about two-thirds the whole length. Cephalic shield semicircular, or a little wider than long, with the anterior and antero-lateral borders regularly rounded in outline, and provided with a narrow, slightly defined marginal rim; posterior margin nearly straight, with the lateral angles terminating in abruptly pointed extremities, so short as scarcely to project as far backward as the posterior margin of the second thoracic segment. Glabella depressed nearly even with the cheeks, about two-thirds as long as the entire head, and between one-third and one-fourth the breadth of the same behind, but narrowing forward to its subtruncated anterior end, and separated from the cheeks on each side and in front by a shallow furrow; occipital furrow moderately well defined, and continued as rather deep broad furrows along the posterior margins of the cheeks out nearly to the points where the facial sutures cut the margin; lateral furrows not clearly defined in the specimens, but apparently consisting of four pairs. Facial sutures directed at first, for a short distance, forward from the inner anterior end of each eye, then curving gracefully outward as they extend forward, until near the anterior margin of the head, where they are a little wider apart than the distance between the eyes, but again curving rather abruptly inward, so as to reach the anterior margin nearly on a line with each eye; posteriorly these sutures extend at first outward, nearly at right angles to the longitudinal axis, from the posterior end of each eye, and then curve gracefully backward so as to intersect the posterior margin between one-fourth and one-third the distance from the lateral angles, inward toward the glabella. Eyes rather depressed, slightly arched outward, and separated from each other by a space somewhat less than half the entire breadth of the head, and placed less than their own length in advance of the posterior margin, and about once and a half their length behind the front margin of the head; visual surfaces narrow, and not showing any lenses under a good magnifier.

Thorax with its length bearing the proportions to that of the head, of 79 to 1870.]

52, and to its own breadth of 79 to 107, being very slightly wider near the middle than in front, and narrowing posteriorly, with gently convex lateral margins, from behind the middle to the pygidium. Axial lobe depressed narrow, or only about two thirds the breadth of each lateral lobe at its anterior end, and narrowing regularly with straight sides posteriorly, segments fifteen, nearly or quite straight, and each with a small node or prominence at each end.\* Lateral lobes depressed or nearly flat; pleurae almost straight or arching slightly backward, to near the extremities, which are abruptly pointed, each with a well defined furrow, which commences small near the anterior inner end, and widens and deepens for about half-way out, and then narrows and becomes more shallow, so as to die out before reaching the lateral extremities.

Pygidium subsemicircular, being rounded posteriorly, with a narrow, slightly flattened border, and somewhat rounded anterior lateral extremities; length bearing to that of the thorax the proportions of 30 to 73 and to that of the head of 30 to 52, with a breadth of not quite two-thirds of that of the head; axial lobe more than two-thirds the length, narrow, depressed and showing more or less distinctly about five segments, lateral lobes much depressed, nearly twice as wide at the anterior end as the middle one, each with about three segments, which curve a little backward and become obsolete before passing upon the narrow smooth border, segments each provided with a comparatively large longitudinal furrow, corresponding to those on the pleurae.

Entire surface apparently smooth, excepting fine radiating striae on the anterior and lateral portions of the cephalic shield that are scarcely visible without the aid of a magnifier.

Whole length, 1.60 inch; breadth of thorax, 1.07 inch, do. of cephalic shield (somewhat flattened by pressure), about 1.12 inch, length of thorax 0.70 inch; do. of pygidium, 0.40 inch, breadth of do., 0.60 inch.

Of this fine Trilobite three entire specimens and a part of another were obtained. They are, however, all merely sharply defined natural casts formed by the deposition of a crust of arragonite in the original moulds left by the fossil in some kind of a matrix. The specimens were evidently somewhat flattened by pressure before or at the time they left their impressions in the rock. This compression has obscured the lateral furrows of the glabella and most of the other characters of the upper side of the fossil are clearly seen, even to the facial sutures, and the faintly marked radiating striae seen around the front and lateral margins of the cheeks.

The genus *Conocephalites* (or more properly *Conororyphe*, for a strict application of the rules of priority would, I should think, require that the latter name should be adopted for the genus to which they were both applied) is so nearly allied to *Olenus* that it may not be always easy to distinguish the two types without seeing the hypostoma, and hence it is possible that the form under consideration may be more properly an *Olenus*. As it has more the regular oval outline of the former, and less pointed and produced pleura than the latter while it shows clearly the fine radiating striae around the anterior and lateral margins of the head so often seen in *Conocoryphe*, it more probably belongs to that genus. It is worthy of note, however, that all of the specimens seem to be much more depressed or flattened than any of the species yet described of that genus, while only one of them shows any traces of the pleural ridge usually seen passing from the anterior end of each eye to the front extremity of the glabella, and in this one the ridge is so faintly marked as to leave doubts whether or not it is natural.

*Locality and position.* Antelope Springs, Dryont Mountains, Nevada. Lower Silurian, and probably, judging from the known position of the genus *Conocephalites*, in the rocks of this country and Europe, from the Primordial zone.

\* In some specimens these nodes seem to be wanting, while in others they do not exist on all of the segments.

May 3d.

DR. KENDERDINE in the Chair.

Eleven members present.

PROF. LEIDY exhibited the internal organs of generation of a Hog, which were of an anomalous character, and had been sent to him for examination by Dr. S. C. Thornton, of Moorestown, New Jersey. The animal, Dr. Thornton informed him, had been bought for breeding purposes, and from outward appearances was considered as a good sow. The animal was frequently in heat, and as often received the boar. At these periods it would froth at the mouth, and champ in the manner usual under such circumstances in the male. As the animal would not breed, it was fattened up for meat, and when killed, the butcher, surprised at the peculiar appearance of the internal genital organs, sent them to Dr. Thornton. The condition of the external organs the latter did not ascertain, as they had not been preserved.

In the specimen exhibited, the uterus and vagina were about as well developed as ordinarily in the sow, but approaching the usual position of the ovary, the uterine horns abruptly narrowed into an impervious cord extending along the inner edge and included in the peritoneal fold enclosing an epididymis.

A testicle with the epididymis occupied the usual position of an ovary in relation with the uterus. The testicles were equally well developed on both sides, but no traces of ovaries were evident. The body of the testicle measured about an inch and a half long, by one and a quarter broad, and one thick. The interior exhibited the ordinary appearance. The well developed epididymis terminated in a vas deferens extending along the course of the uterine horns, enclosed in the fold of the broad ligament, to the anterior wall of the vagina, in which it pursued its way to the incised extremity of the latter. The vaginal portions of the vasa deferentia were enlarged and provided with lateral cœca. The epididymis and vas deferens were distended with a milky liquid, but this on examination was found to contain no spermatozoa, only epithelial cells and granular matter.

---

May 10th.

The President, DR. RUSCHENBERGER, in the Chair.

Twenty-four members present.

---

May 17th.

The President, DR. RUSCHENBERGER, in the Chair.

Thirty-five members present.

PROF. LEIDY directed attention to a few fossil bones lying on the table. One of the specimens, a well preserved tibia, had been obtained by Prof. Hayden from the pliocene formation of Little White River, a tributary of White River, in the Mauvaises Terres of Dakota. A second specimen, a radius, looking as if it might have belonged to the same skeleton as the former, together with an astragalus, were found by Prof. Hayden in the pliocene deposit of the Niobrara River, Nebraska. These bones indicate a small robust species of *Rhinoceros*, not likely to have been the same as the *Hyrcodon Nebrascensis* or the *Aceratherium occidentalis*, which belong to the miocene formation of the Mauvaises Terres. They are too small to have belonged to the *Rhinoceros crassus*, whose remains were found in association with two of the specimens. Their relation to *R. meridianus* of Texas, *R. hesperius* of California, and *R. matutinus* of New Jersey is uncertain.

1870.]

— **1** —

**Abstract**

— 4 —

$$- \quad \cdot \quad - \quad \frac{\partial}{\partial x} \quad \frac{\partial}{\partial y} \quad \frac{\partial}{\partial z} \quad \frac{\partial}{\partial t}$$

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840.

1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

\_\_\_\_\_

100

1. *Journal of the American Medical Association*, 1997; 277: 1033-1038.

1. *Phragmites australis* (Cav.) Trin. ex Steud.

\_\_\_\_\_

• **What is the purpose of the study?** The purpose of the study is to determine the effect of a 12-week resistance training program on the strength and endurance of the lower extremities in healthy young adults.

100

1. *Chlorophyll a* (Chl *a*)

[illegible]

1. *Chlorophyll a* and *Chlorophyll b* were determined by the method of Arar and Collins (1971) using a Shimadzu 1010 UV-Visible Spectrophotometer. The concentration of chlorophyll was expressed in  $\mu\text{g mL}^{-1}$ .

— *Journal of the American Medical Association*, 1997

[illegible]

1. *Journal of the American Medical Association*, 1997; 277: 1033-1036.

<sup>a</sup>  $\chi^2 = 0.76$ ,  $p = .82$ .

100

Figure 1. The effect of the concentration of the *Agaricus bisporus* spores on the growth of *Agaricus bisporus* on the substrate. The concentration of the spores was 10<sup>4</sup> spores/g substrate (A), 10<sup>5</sup> spores/g substrate (B), 10<sup>6</sup> spores/g substrate (C), 10<sup>7</sup> spores/g substrate (D), 10<sup>8</sup> spores/g substrate (E), 10<sup>9</sup> spores/g substrate (F), 10<sup>10</sup> spores/g substrate (G), 10<sup>11</sup> spores/g substrate (H), 10<sup>12</sup> spores/g substrate (I), 10<sup>13</sup> spores/g substrate (J), 10<sup>14</sup> spores/g substrate (K), 10<sup>15</sup> spores/g substrate (L).

One of the collections, received from the Smithsonian Institution, and obtained by Clarence King during the U. S. Geological Exploration of the 40th parallel, consists of specimens found on Sinker Creek, Idaho. These indicate a later tertiary formation like that of the Niobrara River. Among them are fragments of jaws and teeth of *Mastodon mirificus* and of *Equus excelsus*, both of which belong to the Niobrara pliocene fauna.

A second collection, accompanying the former, consists of specimens obtained by Mr. King in Utah. Among them are remains of *Protohippus perditus*, *Merychippus mirabilis*, and *Cosoryx*, all of which belong to the Niobrara pliocene.

A third collection, received from Prof. H. S. Osborn, of Lafayette College, Easton, Pa., was obtained on John Day's River, Oregon. The fossils indicate a miocene fauna and formation like that of the Mauvaises Terres of White River, Dakota. Among them are remains of *Oreodon Culbertsoni*, and what is suspected to be *Stylenys Nebrascensis*.

A fourth collection, received yesterday from the Smithsonian Institution, was obtained by the Rev. Thomas Condon, of Dalles City, Oregon, from the same locality as the latter. It consists of a few specimens, mostly uncharacteristic fragments, but among them are recognized several which pertain to species of the miocene fauna of the Mauvaises Terres. Small fragments of jaws with portions of molars belong to *Oreodon Culbertsoni*, though two exhibit slight peculiarities. In an upper molar of one, a small accessory fold projects from the outer concavity of the postero-internal lobe, as in the Deer. In another specimen the inner surface of the outer lobe of part of a molar is longitudinally rugose. In a third specimen there is no peculiarity. Another small fragment of an upper jaw, with portion of a molar, apparently belongs to *Agriochærus latifrons*. The specimens indicated are labelled "John Day's, Oregon."

Accompanying the last collection there is a portion of the head of a tibia, about the size and form of the corresponding part in a Horse, thoroughly petrified, and marked "Alkali Flats, Oregon." A few additional but uncharacteristic fragments are marked "Crooked R. D."

PROF. LEIDY further made some remarks on *Hadrosaurus* and its allies, as follows: In the "Synopsis of the Extinct Batrachia and Reptilia," published August, 1869, Prof. Cope has referred the supposed dinosaur *Thespesius* to *Hadrosaurus*, apparently from my not having expressed the distinctive characters of the two genera with sufficient clearness.

Specimens of teeth of a herbivorous dinosaur, obtained by Dr. Hayden on the Judith River, a tributary of the Upper Missouri, I referred to a relative of the Iguanodon with the name of *Trachodon* (Pr. A. N. S. 1856, 72; Trans. Am. Phil. Soc. 1859, xi, 140).

At the same time several vertebræ, together with an ungual phalanx, collected on Grand River, were referred to a genus with the name of *Thespesius* (Pr. 1856, 311; Trans. Am. Phil. Soc. 1859, xi, 151).

Subsequently the great part of the skeleton of an *Iguanodon*-like animal was discovered in the green sand formation of New Jersey, and described by me under the name of *Hadrosaurus* (Pr. 1858, 215; Cret. Rept. U. S. 1865, 76).

The teeth of the latter animal are identical in form with the most characteristic specimen originally referred to *Trachodon*, but differ in having the enameled border of the crown tuberculate.

Recently I have regarded *Trachodon*, as indicated by the teeth, as not distinctive from *Hadrosaurus* (Pr. 1868, 199).

From my remarks that "had the remains of *Thespesius* and *Trachodon* been found in a deposit of the same age I should have unhesitatingly referred them to the same animal" (Cret. Rept. 84), Prof. Cope, from a misconception of the meaning, has regarded *Thespesius* the same as *Hadrosaurus*.

The difference in character of the corresponding vertebræ render the two genera distinct, though, as in a multitude of other instances, they may have possessed teeth nearly alike, or even identical in form and construction.

1870.]

The caudal vertebrae of *Hadrosaurus* are biconcave or amphicælian; those of *Thespesius*, at least the larger, more characteristic ones, are convexo-concave or opisthocælian.

In the present condition of knowledge of the remains of *Hadrosaurus* and its allies, the following appear as distinct:

#### HADROSAURUS.

Caudals biconcave or amphicælian; cervicals and dorsals convexo-concave or opisthocælian.

##### HADROSAURUS FOULKII.

Leidy: Pr. A. N. S. 1858, 218; Cret. Rept. U. S. 1865, 76, pls. ii, figs. 9—11; viii, fig. 13; xii, xiii, figs. 1—19, 24—28; xiv—xvii, figs. 4, 5.

Crowns of the teeth tuberculate at their enameled margins.

##### HADROSAURUS MIRABILIS.

*Trachodon mirabilis*, Leidy: Pr. 1856, 72; Trans. Am. Phil. Soc. 1859, 140.

Crowns of teeth non-tuberculate at the enameled margins.

*Remarks.*—The non-tuberculate character of the borders of the teeth was not unlikely associated with others in the skull, &c., which if known would probably separate this species as a distinct genus from *Hadrosaurus*.

##### HADROSAURUS TRIPOS.

Cope: Pr. A. N. S. 1869, 192.

Founded on several caudals from the cretaceous formation of Sampson Co., North Carolina. The robust character of the vertebrae, with their strongly developed articular processes for chevrons, recalls to mind the caudals of *Iguanodon*, as represented in Tab. xxxvii of Owen's Monograph of the Reptilia of the Cretaceous Formation, published by the Palæontographical Society. The specimens probably represent a true *Iguanodon*.

##### HADROSAURUS MINOR.

Marsh: Pr. A. N. S. 1870, 2.

Indicated by several vertebrae from the cretaceous green sand of New Jersey.

#### THESPESIUS.

Caudals convexo-concave or opisthocælian.

##### THESPESIUS OCCIDENTALIS.

Leidy: Pr. A. N. S. 1856, 311; Trans. Am. Phil. Soc. 1859, 151, pl. x, figs.

limited regions in England in the course of fifteen months. In seeking for the source of the small thread-worm, or *Oxyuris vermicularis*, which infests man, I have also been led to discover some new species, of which I propose in due time to publish descriptions with drawings. As is commonly the case in organic nature, we find the specific form changing with the change in condition, but the species are often found to differ where difference in the conditions are hardly appreciable.

Mr. Bastian, in a note to his description of the Vinegar-eel, *Anguillula aceti*, says he was indebted to Dr. Davaine for the opportunity of examining the animals, and adds that "they are much less frequent than is generally imagined, at all events in England; and this may be due in great measure to the adulteration of our vinegar with sulphuric acid." It would thus appear that the *Anguillula aceti* he examined was contained in a specimen of what may be suspected to have been the wine vinegar of France. The cider vinegar so commonly used in this country usually teems with Vinegar-eels. Our cruets, when held up to the light, even to the sharp sight of a naked eye frequently exhibit the worms swarming, especially at the border of the surface, as if in search of both air and light. By comparison of our cider Vinegar-eel with Mr. Bastian's description and drawings of the true *Anguillula aceti*, which I infer to be the wine Vinegar-eel, it appears to belong to a different species. From the descriptions of previous authors of the European Vinegar-eel, I had considered ours as the same. I shall not now give a description of the animal, proposing to do so in future, together with other species. I may say, however, while it has nearly the size and form of the *Anguillula aceti*, it has the œsophagus of the form in the genus *Cephalobus* of Bastian.

June 21st.

WM. S. VAUX, Vice-President, in the Chair.

Twenty members present.

PROF. LEIDY remarked that the two fossils presented this evening by Dr. W. F. McAllister, of Burlington, Kansas, were obtained in that vicinity from gravel, at a depth of thirty feet, in digging a well. One of the specimens consists of a plate from a large molar of the American Elephant, *Elephas Americanus*. The other is the fore part of a ramus of a lower jaw of an Ox, perhaps of a large individual of the *Bison Americanus*. In comparison with the corresponding part of the jaw of the existing animal, the measurements are as follow:

|   | Fossil.   | Recent jaw. |
|---|-----------|-------------|
| Depth at fore part of first molar.....    | 24 lines. | 21 lines.   |
| Depth at incisive foramen .....           | 26 "      | 24 "        |
| Depth at lowest part of hiatus .....      | 21 "      | 18 "        |
| Length of hiatus in advance of molar..... | 52 "      | 52 "        |
| Thickness below first molar.....          | 14 "      | 11 "        |

PROF. LEIDY further stated that he had recently received for examination a small collection of fossils, through the New York Lyceum of Natural History and the aid of his friend Mr. George N. Lawrence, which belonged to Mr. Wm. Newcomb, of New York. The collection is said to have been brought from the Rocky Mountains, but the exact locality has not yet been ascertained. Most of the fossils consist of fresh-water shells, evidently of tertiary age, but adherent matrix indicates them to have been derived from several different strata. Accompanying them there are a few bones, of which one is the coronary bone, apparently of *Equus excelsus*; the others mostly pertain to two fishes, a large cyprinoid and a ray. As the living cyprinoids are fresh-water fishes, the association of the remains of a ray may perhaps indicate that this was also a fresh-water species, though it is not unlikely that it may belong to 1870.]

a marine formation. The two fishes, apparently extinct species and genera, not previously noticed, are indicated by the remains briefly described as follows:

*OSCEBATIS PENTAGONICA* (Osac, a boss or tumor; *Jaw*, a ray).—Founded on a dermal boss, with a pentagonal outline, the sides of which are convex. Under surface strongly convex. Upper surface with five planes sloping from a central summit and defined by as many prominent borders. From the summit an oval enameloid areola occupies rather less than half the extent of the upper surface. The areola is shining, nearly smooth, and exhibits concentric lines of structure. The very summit of the boss appears composed of a harder, more translucent substance protruding through the opaque white areola. Greater diameter of the boss, 15 lines; shorter diameter, 15 lines; thickness from summit, 8 lines; greater width of areola, 8 lines; shorter width, 6 lines.

*MYLOCTIPHTIS ROSCATIS*—Founded on specimens of pharyngeal bones with teeth. There are eight of them of different sizes, all imperfect. The largest have been double the size of the smallest, and perhaps they may have pertained to several species. They are robust, and indicate a large and powerful fish. They have the general form of the posterior pharyngeals in the carp and other cyprinoids. The posterior ramus is prolonged above in a stout pedicle, with an inner triangular articular surface for attachment to the cranium. Its posterior surface, below the pedicle, is broad, nearly flat, with the outer border convex and acute, the inner border concave and sustaining a single row of teeth.

The anterior ramus is thick, and abruptly narrows forward, but is broken at its fore part in all the specimens. At the angle of conjunction of the rami the bone is massive, thicker fore and aft than transversely. The outer border of the bone forms two flexures. The antero-external surface is broad, vertically concave, transversely convex, in some cases entire, in others excavated into pits communicating with the bottoms of the teeth or extending through the bone where the latter have been shed.

The teeth form a single vertical row of four, and are supported on the inner side of the conjunction of the two rami of the pharyngeal bone, projecting a short distance below the level of the inferior ramus, and extending rather more than half-way up the superior ramus. They have stout bony bases, and are of the true masticatory type. They bear a striking resemblance to human premolar teeth—the largest in size as well as form. They are all of the same

No. 1 appears to be from an old individual; the teeth have all been shed or broken away. No. 2 is the most robust specimen. The uppermost tooth has been shed and not replaced. The bone is not excavated in pits beneath the position of the contained teeth. No. 3 has the upper tooth shed and the bone perforated in its position. The lower three teeth are retained, but half worn away. In No. 4 the bone is perforated in the position of the upper shed tooth. In Nos. 5 and 6 the bone is perforated in the position of the upper shed tooth, and deep pits exist beneath the position of the two teeth below.

Since communicating the above, Prof. Hayden presented a specimen of a pharyngeal bone of the same fish from Castle Creek, Idaho.

---

June 28th.

The President, DR. RUSCHENBERGER, in the Chair.

Thirteen members present.

---

July 5th, 1870.

The President, DR. RUSCHENBERGER, in the Chair.

Fifteen members present.

The following papers were presented for publication :

"Remarks on Huxley's Classification of Birds." By T. Hale Streets.

"On the Stipules of Magnolia and Liriodendron." By Thomas Meehan.

The resignation of Mr. Gilbert Coombs as a member was read and accepted.

MR. MEEHAN exhibited some specimens of *Rumex oblongifolius*, a naturalized Dock from Europe. He said that so far as he could ascertain from European specimens, and the descriptions of Babington, Bromfield and other English botanists, the plant was there hermaphrodite; but here, as correctly stated by Dr. Asa Gray, it was monœciously polygamous. He thought the fact that plants hermaphrodite in one country becoming unisexual in another, was worthy of more attention by those engaged in the study of the laws of sex than had been given to it. This *Rumex* did not stand alone; *R. crispus* and *R. patientia* exhibited the same thing. *Fragaria* was another instance well known to horticulturists, although the fact scientifically had not received due weight. The average tendency of the strawberry in Europe was to hermaphroditism,—here to produce pistillate forms.

He also called attention to the fact that in these American specimens unisexuality was in proportion to axial vigor. This law he had already explained in times past to the Academy, and new instances were scarcely necessary. Here, however, the moderately weak plant had more hermaphrodite flowers than the strong one; and in both classes of specimens the number of male flowers gradually increased with the weakening of the axis, until the ends of the raceme were almost wholly of male flowers. The first flowers on the strong verticels were usually wholly pistillate.

PROF. COPE inquired whether the facts now noted by Mr. Meehan did not conflict with those he had before brought to the notice of the Academy in coniferous plants? He understood that in them the female flowers were at the apex of the young shoots, and the male flowers in lower and more exterior positions.

MR. MEEHAN replied that the facts were identical in both instances in this, 1870.]

that the female flowers in coniferous plants were borne only on the strong vigorous shoots. These vigorous shoots would in time be crowded and weakened by shade, when they would cease to bear female, and produce male flowers only.

PROF. COPE suggested that, without reference to the relative vigor of the shoots, the male flower was below, and the female flower above, in these Docks the female flower was below, and the male above.

MR. MEEHAN said he had never placed any value on relative position, unless relative vigor went with it. In the case of coniferous trees,—*Pinus* particularly,—the male flowers were evidently partially formed the fall before expansion, and at the same time that bud scales were forming, and growth forces nearly at rest for the season. They were still in the weaker position, although appearing at the base.

PROF. LEIDY remarked that the interesting communication of Mr Meehan had recalled to his mind a result of his experience, which he thought would accord with that of others,—viz : that species viewed as common to both Europe and America frequently exhibit slight peculiarities, which are distinctive of those of the two countries. It is what might be inferred even if we admit the evolution of existing species from a common remote ancestry. A wide separation, with a considerable lapse of time and a modification of circumstances, are sufficient to account for the slight and acquired differences. Even where differences are not observed in form and structure, they may exist in the habit of the species. Thus the common wolf of Europe and America, viewed by many naturalists as of the same species, differs strikingly in character in the two countries. In the former it is a more fearless animal, not hesitating to attack man; in the latter, it is said never to attack man.

At an early period observers saw, or thought they saw, many of the same species of plants and animals indigenous to America that occur in Europe, and hence the common names of European species were applied to those of America. Gradually the list of species common to the two countries was much reduced, and now is comparatively small.

As might be anticipated, in descending in the scale the species common to the two countries become more frequent; nevertheless many of these common species exhibit geographical peculiarities, which by some naturalists would be regarded as sufficient to consider them distinct. The singular rotifers *Hydractinia ringens* and *Limnias ceratophylli* are described by European authors as being most generally solitary. Here they frequently occur in compound bunches, up to several dozen in a bunch. Agassiz observes, "In the American *Hydractinia* as in the European there are two types—the brown and the

length of the body, which is about five lines. In one instance I saw a brown Hydra from the Schuylkill, the body of which was five lines in length, elongate its arms to nearly three inches. The green Hydra is found more especially on the under side of floating leaves in quiet ponds. It usually has five arms, though I have observed six, and more rarely seven; and this is also the case with the brown Hydra, which sometimes has but four arms. As in *H. viridis*, the arms of our green Hydra are shorter than the body.

---

July 12th.

The President, DR. RUSCHENBERGER, in the Chair.

Ten members present.

POOF. LEIDY exhibited a fossil, submitted to his examination by the Smithsonian Institution. It consisted of a much mutilated portion of a ramus of the lower jaw of a large ruminant. The specimen, very friable and encrusted, was found 22 feet below the surface, in clay, on the "bench" or "second bottom" of Boyer River, Harrison Co., Iowa, and was presented to the Smiths. Inst. by D. R. Witter, of Woodbine, Iowa. Other bones were discovered in association with the specimen, but crumbled to pieces.

The jaw fragment was especially interesting, as it is supposed to belong to *Ovibos cavifrons*, and is the first specimen of a lower jaw yet discovered which may be attributed to that animal. It contains the last molar tooth nearly entire, but much worn. This tooth is constructed after the type of the corresponding one in the Sheep, and exhibits no trace of the accessory fold between the anterior and median pairs of lobes such as exists in the Ox, nor of a tubercle such as is found in the same position in the Deer. The fore and aft measurement of the crown of the tooth is full two inches; the width at the fore part of the crown is nearly an inch.

An isolated tooth, a last lower molar which had not yet protruded from the jaw, from Natchez, Mississippi, preserved in the Museum of the Academy, by comparison with the tooth in the jaw fragment, would appear to belong to the same animal. The specimen is two and a quarter inches long and three-fourths of an inch wide at the fore part, and is two inches in its antero-posterior measurement.

MR. T. HALE STREETS made the following remarks on the cranium of an owl:

Among the Academy's collection of birds' crania there is one belonging to a species of owl (supposed to be the *Nyctale acadica*), which presents a very remarkable instance of the want of symmetry in corresponding parts of opposite sides.

In this skull the squamous portion of the temporal bone is thin and scroll-like, and joins the post-frontal plate. What is interesting about it is the manner in which this union takes place. On the right side the lower end of the scroll-like squamous bone turns upward and forward, and unites with the post-frontal. On the left side the contrary to this is the case; the upper extremity of the bone curls over and joins the post-frontal, while the lower extremity is free.

If there had been but a single specimen of this cranium I would have been led to regard this instance of symmetry as abnormal; but as the same peculiarity of structure is presented by two (these being the only representatives of the species in the collection), it would rather suggest itself as a normal condition, although instances of coincidence of abnormality exist, especially in the lower forms of life.

---

July 19th.

The President, DR. RUSCHENBERGER, in the Chair.

Fourteen members present.

1870.]

PROF. LEIDY exhibited a fossil which had been submitted to his examination by Prof. Hayden, who obtained it on the Moreau River, a tributary of the Upper Missouri, and was probably derived from the cretaceous formation. The specimen consists of the body of a vertebra of a saurian, devoid of the neural arch, which was separated at the suture. It bears a resemblance to the corresponding part of *Nothosaurus*, a saurian of the triassic deposits of Europe. The body is cylindroid, moderately narrowed towards the middle, and has the articular ends slightly concave. The sutural connection of the neural arch, including transverse processes, extends some distance down the sides. The measurements of the specimen are as follow: Length of body inferiorly,  $11\frac{1}{2}$  lines; superiorly, 1 inch; depth in front, 11 lines; width, 10 lines.

The specimen probably indicates a marine saurian allied to *Nothosaurus*, and from its resemblance, the animal to which it belonged may be named *Nothosaurops occidentalis*.

July 26th.

The President, DR. RUSCHENBERGER, in the Chair.

Ten members present.

On favorable report of the Committees, the following papers were ordered to be printed:

Descriptions of GRASSHOPPERS, from Colorado.

BY PROF. CYRUS THOMAS.

ANABRUS, Hald.

The characters of this genus were not fully given by Prof. Haldeman when he established it, and those subsequently added by Girard are scarcely sufficient to distinguish it from other closely allied genera. Having both sexes of three species, I give the following as the principle characters that distinguish it.

*Gen. Char.* Head large, smooth, advanced in front between the antennae. Pronotum selliform, extending over the base of the abdomen; rounded and smooth, anterior portion of the sides reaching below the eyes; posterior margin and angles rounded. Prosternum bidentate: posterior angles of the

species is necessary to decide this point. *A. purpurascens*, Uhler, must be excluded from this genus, as the prosternum is not spined; it may belong to *Pterolepis*, Rambur, but I have seen no species of this genus, and therefore cannot speak positively.

*A. STEVENSONII*, n. sp.

*Female.* Purple, mottled with yellow; form and coloring somewhat similar to *A. purpurascens*, Uhler, but smaller and slenderer in all its parts. Face white, the transverse suture below the front fuscus; tips of the mandibles piceous; palpi pale, the penultimate joints of the maxillary palpi striped with purple above; antennæ long and slender, reaching nearly to the extremity of the ovipositor, dusky; cranium cinereous, with the vertex, and a line extending back from each eye, dull white. Pronotum short, not carinated, a slight transverse incision near the front; the two oblique dorsal impressions very narrow and dark; surface smooth, lurid; a large black spot occupying the central portions of the sides behind the transverse incision; lateral margins broadly and anterior margins narrowly bordered with pale yellow; posterior angles tipped with piceous-black. Tegmina hid beneath the pronotum. Abdomen dull purple, somewhat darker along the sides. Ovipositor slightly curved beyond the middle, piceous at the tip; cerci slender, hairy. Beneath, dull white. Anterior and middle legs short, femora slender and straight; posterior legs very long and slender, femora and tibiæ each the length of the body omitting the head; all pale, purplish-yellow; femora smooth; tibia with spines irregularly placed on the angles, also on the rounded portion, black at the tips. The spine above the anterior coxa pale, slender, and bent abruptly downward.

Length 1.13 in.; pronotum .26 in.; posterior femur .93 in.; ovipositor .75.

*Hab.* Southern Colorado, on elevated grassy terraces near the mountains; and the parks. Collected by C. Thomas while accompanying Dr. Hayden's Geological Expedition to Colorado and New Mexico.

It is named in honor of Mr. James Stevenson, a member of the expedition, who has for years accompanied Dr. Hayden in his western explorations, and has been a diligent collector of specimens in all departments of Natural History.

*A. MINUTUS*, n. sp.

*Male.* Similar in coloring and appearance to the *A. Stevensonii*. Face mottled with purple; a dark spot below each eye; a narrow yellow line running back from the upper corner of the eye; cranium cinereous, head somewhat covered by the pronotum. Pronotum short, rounded, smooth; transverse incision almost obliterated; oblique dorsal impressions irregular; the dorsal portion cinereous; sides with a triangular black spot, interrupted by light spaces; broadly margined with dull white; lateral angles tipped with piceous-black. Tegmina short, extending over the second abdominal segment; margins pale yellow, central portions brown. Abdomen cinereous, a darker line along the sides; notch of the sub-anal plate very small; appendages small, hairy; the tip of the last dorsal segment strongly bifid, denticulate. The cerci (I use this term for those appendages supplying the place of cerci) slightly bent, bifurcate. Legs same color as abdomen and cranium; anterior pair quite short; middle pair a little longer; the posterior pair very long, the femur marked with a dark line along the upper angle; tibia slender, spines tipped with brown. Antennæ at least twice as long as the body.

Length .75 in.; posterior femur .62 in.; tegmina beyond the pronotum .1 in.

*Female* similar to the male in appearance, coloring and size. Cerci small, hairy. Ovipositor bent, somewhat narrowed in the middle; brown at the tip.

Length as in the male. Ovipositor .55 in.

*Hab.* Same as *A. Stevensonii*. Some specimens in each of the species have, on the under side of the posterior femur, about four or five abortive spines, 1870.]

especially the older or more mature ones. This may be important in fixing the position of the genus, which is evidently one of transition.

**THAMNOTRIZON, Fischer.**

**T. PERPETRASCENS, Uhler.**

Found in the parks of the Rocky Mountains and on the more elevated plains of Colorado and New Mexico. I have removed this from *Anabrus*, the prosternum not being spined.

**T. TRILINEATUS, nov. sp.**

*Female.* Small, somewhat like *A. minutus*. Thos., but presenting some marked differences. Head moderate size, immersed in the pronotum nearly to the eyes: occiput very short, convex: vertex rounded between the antennæ, slightly advanced in front, this advanced portion triangular and deflexed; face short, broad, smooth, somewhat convex: labrum large, round. Palpi rather longer than usual, slender, cylindrical; terminal joint of the maxillary palpi the longest. Pronotum small, rounded, not carinated; advanced in front over the back of the head, margin round, or sub-truncate; posterior extremity extended over the base of the abdomen, round: sides narrowed below, reach only about the lower border of the eyes: posterior margin of the sides sloped quite obliquely, slightly sinuate. Antennæ reach the tip of the ovipositor. Ovipositor about the length of the body, slightly bent; cerci short, stout, covered with minute depressed hairs: the plate between them triangular. Prosternum not spined. Anterior tibiæ with two spines in front; medial with two rows on the outside 4 (counting the one at the base) and 2. (Posterior legs wanting in the only specimen obtained.)

*Color.* (Siccus) testaceous green striped and varied with pale yellow. Face testaceous, palest below, with a brown spot at each lower corner. Three pale, tolerably broad, yellow stripes reach from the head to the end of the abdomen; one along the back and one along each side. Two oblique black marks on the back of the pronotum about the middle: lower margins of the sides yellow; beneath pale. Ovipositor fuscus. Antennæ fuscus. Legs purplish, tarsi piceous.

*Dimensions.* Length .75 in.; to the end of the pronotum .34 in.; ovipositor .73 inch.

*Hab.* S. E. Colorado.

**EPHIPITYTHA, Serv.**

*Color* (siccus) pale yellow. A roseate stripe on the frontal tubercle; second joint of the antennæ orange yellow; a bright yellow curved line runs from the upper canthus of each eye to the pronotum; there they meet with broader lines on the pronotum, which, converging posteriorly, fade near the middle of the dorsum. Anterior portion of the pronotum dotted with red. Stridulating organs very small, roseate. Elytra and wings pellucid. Abdomen minutely dotted with reddish-brown. Tips of the cerci black.

*Dimensions.* Length .75 in.; to tip of the wings 1.25 in.; wings pass the elytra (about) .25 in.; femur 1. in.; tibia .95 in.

*Hab.* Southern Colorado. Unique specimen.

#### ORCHELIMUM, Serv.

##### O. VULGARE, Harr.

The specimens I have marked as belonging to this species may prove to be new, as they vary considerably from the type.

##### O. GRACILE, Harr.

*Hab.* Found in Colorado.

#### UDEOPSYLLA, Scudd.

##### U. ROBUSTA, Hald.

I have marked my specimens by guess, as I have no description of this species at hand; but think from allusions to it in the descriptions of other species, that my specimens belong there. Found in the parks.

#### CENTHOPHILUS, Scudd.

##### C. DIVERGENS, Scudd.

My specimens vary in having the hind femora of the females spined, spines very short. Yet I am inclined to believe they belong to this species.

#### ACRIDIDÆ.

(*Truxalides*.)

#### OPOMOLA, Serv.

##### O. NEO-MEXICANA, nov. sp.

*Female.* Long, slender, truxaloid. Head conical; occiput convex, ascending to the somewhat elevated vertex; vertex convex, ascending, sub-margined, rotund, rather elongate before the eyes; face very oblique; frontal ridge distinct, sides parallel, slightly sulcate; lateral carinæ distinct, obtuse, divergent, reaching the lower corners of the face. Antennæ strongly ensiform, triquetrous, reaching to the tip of the pronotum; situated in deep foveolæ under the front of the cone. Pronotum about as long as the head; sides parallel; all its parts very regular; tricarinate, carinæ not elevated but distinct, all about equal; obtusely rounded anteriorly and posteriorly. Elytra a little shorter than the abdomen; wings a little shorter than the elytra. Posterior femora reach the extremity of the abdomen; very slender. Prosternal point short and obtuse, scarcely more than a pointed tubercle.

*Color* (immediately after being taken out of alcohol, in which it had been immersed for some months). Face yellow, dotted with red; lateral carinæ rosaceous; on the top of the head a faint roseate stripe runs from the end of the cone to the pronotum, bordered each side by a yellow stripe; from the lower part of each eye starts a bright red stripe which, running back across the head, continues along the upper portion of the side of the pronotum to its extremity and is lost on the elytra. Median carina of the pronotum red, the dorsal spaces yellow; lower portions of the sides yellow. Elytra semi-transparent; base and stripe along the dorsal margin roseate. Wings trans-

parent, veins ochreous. Abdomen dirty yellow, reddish on the basal segments. Legs rufous; posterior femora have a pale stripe along the upper edge, spurs of the posterior tibiae tipped with black.

*Dimensions.* Female. Length 1.62 in.; to tip of elytra 1.50 in.; to extremity of pronotum .52 in.; femur .88 in.; tibia .86 in.

*Hab.* N. E. New Mexico.

I have not seen the male. This species comes near *O. mexicana*, Sauss., but differs from it in the following respects: The antennae are not rotundate, but sharply triquetrous; the pronotum is carinate, although the carinae are but raised lines; and although the posterior lobe is minutely punctured the pronotum cannot be truly called densely punctate. This species approaches closely to *Truxalis*.

(*Mucronate.*)

#### ACRIDIDIUM, Geoff.

##### A. FLAVO-FASCIATUM, De Geer.

But one specimen obtained, near the line between Colorado and New Mexico.

#### CALOPTENUS, Serv.

##### C. SPRETUS, Uhler.

##### C. BIVITTATUS, Say.

I have other *Calopteni* which approach very near these species, yet appear to be distinct, but I will not attempt to name them until I have an opportunity of further comparison.

#### PEZOTETTIX, Burm.

##### P. NORZALIS, Scudd.

In the cañons and parks of the mountains.

##### P. PICTA, nov. sp.

Medium size, body elongate, stout, sub cylindrical. Occiput convex, vertex sloped, flat and narrow between the eyes, suddenly widening in front, this part transverse and triangular; the frontal ridge somewhat convex, with a very slight depression at the central ocellus, eyes large, prominent, oval; antennae filiform, nearly as long as head and thorax. Sides of the pronotum parallel in the male, and very slightly divergent posteriorly in the female; carinae obliterated by the sub-cylindrical form; posterior margins of the sides obliquely sloped but not sinuous, posterior angle rounded; a slight transverse incision each side close to the front margin; the three usual transverse incisions distinct, crossing the dorsum in the female, the posterior one on y

When alive this is a very pretty insect, stripes of red, black and white alternating; when immersed in alcohol the red fades, and the black becomes paler.

(*Mutici*.)

BRACHYPEPLUS, Charp.

As Charpentier, at the time he established this genus, failed to give its characters, and the description of Girard is so short and deficient, I give, from a large number of specimens, what I conceive to be the distinguishing characters.

*Gen. Char.* Body very robust, acridoid. Occiput broad, convex, smooth; vertex margined; frontal ridge broad, short, slightly sulcate, expanding below; lateral carinæ distinct, with a sulcus behind each; antennal foveolæ deep, oblong; cheeks prominent. Pronotum large, elongate, tricarinate; carinæ distinct, continuous; widest below, expanding posteriorly, sides straight, chagrined above, sides glabrous; no transverse incisions on the dorsum; anterior margin rounded, extending slightly on the head; posterior margin round. Elytra and wings rudimentary (in the known species). Legs very robust; posterior femora long as the abdomen, swollen; tibiæ strongly spined nearly the entire length. Antennæ filiform, joints distinct; long as head and thorax. Sub-anal plate of the male tumid; cerci very short; female appendages stout, broad.

A well marked and distinct genus.

*B. MAGNUS*, Girard.

This ponderous species is easily recognized by fig. 1, pl. xv, Marcy's Expl. Red River La., but the description is quite deficient; therefore, to aid future investigations, I give it more minutely.

(*Siccus*). Yellow, spotted with brown. Occiput very slightly scabrous; with fine shallow punctures; elevated margins of the vertex meet in about a right angle at the front; frontal ridge, although narrow above and gradually expanding as it descends, is not narrowed opposite the antennæ, margins distinct obtuse; sulcus shallow, expanding and fading below, punctured. Pronotum with three distinct, continuous, piceous carinæ; dorsum strongly chagrined, yellowish, with æneous lustre; sometimes, especially in the females, there is a yellow line along each margin of the dorsum; sides purplish at the upper angles, yellowish below. Elytra ovate, reaching the third abdominal segment; nerves longitudinal, slightly branching near the extremity; light brown spotted with black. Wings very small, yellow. Abdomen carinated above; each segment with a brown spot each side, and margin marked with a row of white dots.

Legs as described by Girard.

*Dimensions.* Length (female) 2 in.; pronotum .55 in.; elytra .3 in.; femur 1.25 in. Males about one fourth less; size varies considerably.

*Hab.* First observed near Arkansas River (going south) in the vicinity of Canon City. From thence southward to Santa Fe, N. M.

ÆDIPODA, Latr.

Æ. CORALLIPES, Hald.

*Dimensions.* Female. Length 1.80 in.; femur .90 in.; tibia .75 in.; to tip of elytra 2 in. Male about two-thirds as large as the female.

*Hab.* Found at Cheyenne; along the Divide, and south of Raton Mountains. The bright vermillion tint of the posterior legs fades in alcohol. I am inclined to believe the *Æ. pardalina*, Sauss, is synonymous with this species.

Æ. CAROLINA, Linn.

Found occasionally throughout our route.

1870.]

*C. AQUALIS*, Say.

Colorado. Appears to be replaced further south by *C. pruinosa*, Thos., a very closely allied species.

*C. PRUINOSA*, nov. sp.

About the size and somewhat similar in coloring and appearance to *C. aqualis*, Say, but broader across the meso- and meta-thorax. Head oblong, seen from the front or side; occiput convex, ascending; vertex strongly declined, broad, flat, not foveolate, very slightly margined, slightly contracted between the eyes; frontal ridge prominent and rounded anteriorly above, somewhat sulcate below, expanding at the ocellus, and slightly contracted immediately below it, divergent and fading near the clypeus; lateral carinae distinct, sinuous and divergent below (in the males these carinae are more distinct and extended than in the females). Pronotum short, sub-cylindrical and somewhat coarctate in front, expanded and more angulate posteriorly, cross incisions 1 and 3 apparent, 2 very indistinct in the male, apparent on the sides in the females, 1 arcuate above, 3 slightly sinuous and situated about the middle of the pronotum; central carinae merely a raised line; the lateral carinae obliterated in front, obtuse on the posterior lobe; truncate in front, posterior angle obtuse. Elytra and wings considerably longer than the abdomen. Posterior femora broad, not reaching the extremity of the abdomen. Antennae stout, reaching the middle of the abdomen in the males, a little shorter in the females, joints distinct.

*Male.* Color (siccus). Ash-colored varied with brown. Head pruinose, except the vertex, which is mouse-colored. Pronotum lilac on the back, sides pruinose. Elytra crossed by three broad fuscus bands, middle one the broadest and darkest; apex transparent. Wings transparent yellow at the base; crossed by a dusky band as in *C. aqualis*; apex pellucid. Posterior femora pruinose at the base, crossed by an oblique brown band beyond the middle; tip brown; basal half of the inside black; tibiae orange yellow, tarsi pale. Venter pale yellow. Antennae fuscus.

Female differs as follows: Seldom pruinose; occiput brown; pronotum reddish-brown, varied with dots and lines of yellow. The front part of the pronotum more regular and smooth; the posterior lobe of each is densely punctured, but that of the female is intersected by irregular, slightly raised lines. The dark lines across the elytra narrower, paler and more irregular.

*Dimensions.* *Male.* Length 1.10 in.; to tip of elytra 1.42 in.; pronotum .36 in.; femur .60 in.; tibia .58 in. *Female.* Length 1.48 in.; to tip of elytra 1.70 in.; pronotum .34 in.; femur .78 in.; tibiae .70 in.

*Hab.* Quite abundant in Southern Colorado and Northern New Mexico

antennæ, (the lower a little broader than the upper) converging behind these they pass through the eye (plainly to be seen in fresh specimen) and become a single black stripe behind the eye which reaches to the posterior incision of the pronotum, decreasing in width as it passes along the lateral angle. Pronotum ash-colored on the dorsum, posterior lobe palest, with minute brown tubercles scattered over it, a dark brown spot on each side. Elytra brown, darkest next the base, semi-transparent at the apex. Wings transparent yellow next the base; apical half dusky; this dark marginal band is broad in front, but tapering toward the inner angle but does not reach it; reaches along the front submargin nearly to the base; is somewhat darkest at the inner and outer borders, reaching to the apex. Posterior femur reddish with two oblique darker bands on the outer face, and three black bands inside.

*Dimensions.* Length 1 in.; to tip of elytra 1.26 in.; to the end of pronotum (from the front of the head) .31 in.; femur .54 in.; tibia .44 in.

*Hab.* New Mexico.

*Æ. CARLINIANA*, nov. sp.

*Female.* This species at first sight has much the appearance of *Æ. Carolina*, but an examination of the head or thorax, or spreading the wings will soon undeceive the observer. Although smaller than that species it is more robust, compared with its length. Head carved much the same as *Æ. corallipes*. Occiput short, sub-convex, not ascending; vertex very broad, slightly deflexed; the broad shallow central foveola divided by a median carina into two elongate pentagonal spaces, the median carina and margin next the eye being the longest sides; the lateral shallow foveolæ triangular; at the top of the frontal ridge is a lunate depression; frontal ridge somewhat broad, obtusely margined, expanded at the ocellus, vertical, reaching the cross suture; lateral carinæ distinct, reaching the corners of the face. Antennæ filiform, sub-planate. Pronotum sub-cylindrical in front, flat on the lateral lobe, expanded posteriorly, not constricted; median carina a raised line, cut by the cross incisions 1 and 3; posterior incision before the middle; lateral carinæ obliterated in front, distinct on the front of the posterior lobe; posterior lobe densely punctate. Elytra and wings extend slightly beyond the abdomen. Posterior femora short, not reaching the extremity of the abdomen; inflated.

*Color* (siccus). Ash-colored. Vertex and posterior lobe of the pronotum tinged with reddish-brown. Elytra opaque and somewhat brownish at the base, semi-transparent at the apex; dotted with pale brown. Wings when fully expanded present a very broad fuscus band across the base parallel with the body, the outer border reaching beyond the middle; a large triangular space at the apex transparent, with dark and white veins. Posterior femora spotted with black inside; tibiæ yellow.

*Male.* The male differs only in size, and in having the elytra crossed by irregular brownish bands, somewhat as in *Æ. equalis*.

*Dimensions.* *Female.* Length 1.38 in.; to tip of elytra 1.58 in.; to tip of the pronotum (measuring from the vertex) .45 in.; femur .64 in. *Male.* Length 1.16 in.; to tip of elytra 1.26 in.; to tip of pronotum .42 in.; femur .58 inch.

*Hab.* Eastern Colorado.

Named in honor of Col. Carlin, for the assistance rendered the expedition by him.

*Æ. NEGLECTA*, nov. sp.

*Female.* Much like *Æ. corallipes*, about the size of the male of that species, for which it has doubtless often been taken. In its carvings, as well as size, it comes very near *Æ. Mexicana*, Sauss. Vertex very broad, transverse, foveolate; the large central foveola divided, by the recurving margins, into three contiguous foveolæ, these margins, seen from the front, form a W, with a line

1870.]

across the middle angle; lateral foveolæ obsolete; frontal ridge bisulcate above the ocellus, sulcate below, expanded at the ocellus. Pronotum flat above, rough; median carina an elevated line, very distinctly severed by cross incision 3, before the middle; incisions 2 and 3 come together at the carina; anterior portion rugose, posterior lobe covered with elongate tubercles, its sides granulose. Wings and elytra extend beyond the abdomen. Posterior femur about the length of the abdomen. Antennæ filiform, reaching the tip of the pronotum.

*Color (siccus).* Dirty-brown, with fuscus spots. Each elytrum has a narrow yellow stripe near the dorsal border; the base brown, fading toward the apex, which is semi-transparent; marked with groups of fuscus spots which at two points form irregular bands somewhat as in *E. aequalis*. Wings yellow at base; a dark band of moderate width crossing just beyond the middle, curving inward to the posterior angle; apex transparent, veins dusky. Posterior femora crossed on the outside by two very indistinct oblique reddish bands; inside, beneath and tibiae orange yellow (probably bright red in the fresh specimens); spines of the tibiae tipped with black. Antennæ pale at base, apical portion dusky.

*Dimensions. Female.* Length 1.16 in.; to tip of elytra 1.38 in.; to end of pronotum .44 in.; femur .63 in.

*Hab.* N. Mexico.

This species agrees so nearly with *E. Mexicana*, of Saussure, that I would have marked my unique specimen as such, but for the fact that its wings are yellow at the base.

#### TOMONOTUS, Sauss.

*T. NIETANUS*, Sauss.

*T. MEXICANUS*, Sauss.

I have labelled my specimens with some hesitancy, especially those belonging to the first species. *T. nietanus*, when living appears black, and may easily be recognized when flying by its black body and bright red wings. It is closely allied to *E. sulphurea*, Burm., which belongs to this genus.

*T. PSEUDO-NIETANUS*, nov. sp.

*Male.* Size and appearance much like *T. nietanus*, Sauss., from which it differs only as follows: The facial costa is slightly broader and less excavated below the ocellus; the occiput and pronotum less rugose; the antennæ nearer cylindrical. The color is darker, the sides being deep black throughout to the tips of the elytra; the posterior part of the occiput and dorsum of the pronotum are white-yellow. The front, lateral and lateral margins of the pronotum

rowest above; lateral carinæ distinct, strongly divergent below; eyes medium size, ovate. Pronotum short, sub-truncate in front, posterior angle obtuse and rounded; the three transverse incisions distinct and closely approximate, anterior shortest, 2 and 3 connect at their termini on the side of the pronotum by an oblique depression; incision 3 about the middle; median carina distinct, not elevated; lateral carinæ distinct on the anterior lobe and front part of the posterior lobe; the spaces on the anterior lobe between the median and lateral carinæ depressed, basin-like. Elytra and wings about as long as the abdomen. Posterior femora inflated at the base, attenuate near the tip. Pectus not broader than the head. Antennæ filiform, reaching the end of the pronotum.

*Color* (siccus). Yellow varied with brown. Head yellow, occiput dotted with brown, forming imperfect waved lines; antennæ pale at base, remainder brown. Pronotum with a yellow cross on the back, beginning at the lateral angles of the posterior lobe, converging anteriorly they cross about the middle and fade on the anterior lobe; a triangular brown spot on the posterior lobe; sides brownish fading below. Elytra brown, a yellow stripe along the inner margin; lower half dotted with dark brown. Wings transparent, the veins white except at the apex where they are dusky. Posterior femora yellow with two or three oblique brownish spots near the upper edge, which cross and become distinct bands on the inside; knee brown; tibiæ dusky above, and at the tips, rest yellow (probably bluish in fresh specimens.)

*Dimensions. Female.* Length 1.07 in.; to tip of elytra 1.10 in.; to end of pronotum .34 in.; femur .62 in. *Male.* Length .88 in.; to tip of elytra same; femur .60 in.

*Hab.* Eastern Colorado.

Named in honor of Mr. Henry Elliot, artist of the expedition, who, in addition to his arduous duties, was constant in his efforts to collect specimens of Nat. Hist., and who rendered me valuable assistance in collecting plants and insects.

#### BOOPEDON, Thos., nov. gen.

*Gen. Char.* Body somewhat like *Pezotettix*, Burm. Head large, exceeding the thorax in width, widest below; seen from the side presents a somewhat semi-circular front; occiput convex; vertex sloping, broad, sometimes exhibiting a shallow foveola, usually rhomboidal, with a slight median carina; frontal ridge prominent, not sulcate, margins obtuse and nearly parallel. Antennæ nearly as long as head and thorax, inserted in deep oblong foveolæ. Pronotum of medium length, sides parallel; sub-truncate in front; posterior angle obtuse; three transverse incisions; posterior about the middle, cutting the median carina; median carina distinct, not elevated; lateral carinæ obsolete. Elytra shorter than the abdomen in the female, about the length of the abdomen in the male; inflated near the base, narrowed at the apex; two longitudinal veins dividing it into three nearly equal fields. Posterior femora stout, narrowed at the tip, passing the abdomen; tibiæ spined, enlarged at the tip. Ultimate joint of the maxillary palpi enlarged at the end, truncate. Prosternum with the anterior half tumid; latter half divided by a longitudinal sulcus. Pectus sub-convex or flat. Anal appendages of the female short and obtuse; sub-anal plate of the male keeled, trigonal and turned up.

*B. NIGRUM*, nov. sp.

Black, medium size, female much larger than the male.

*Female.* Occiput smooth, a few punctures on the vertex, a faint median line visible; eyes about midway between the front and back margins; frontal ridge convex, with a very slight indentation at the ocellus, punctured on the margin, reaching nearly to the cross suture, where it suddenly expands; lateral carinæ distinct, obtuse, sinuate and divergent; a deep sulcus below each eye. Pronotum nearly as broad as the head; median carina distinct, straight; pos-

1870.]

terior lobe punctate; central portions of the sides levigate; cross incisions 1 and 2 not reaching the median carina. Elytra narrow, covering about two-thirds of the abdomen, lanceolate; the two longitudinal veins strong, approaching at the apex, along the borders, the reticulate veins coarse. Wings shorter than the elytra.

*Color (siccus).* Dark ferrugineous. Lower angles of the face and sides of the lip black. Tips of the elytra black. Apex of the wings dusky, rest transparent. Two reddish spots inside the posterior femora; tibiae transparent red.

*Male.* Similar in coloring only darker. Elytra black, somewhat paler at the base; wings transparent, cloudy at the apex (I think they are roseate when living.)

*Dimensions.* *Female.* Length 1.5 in.; pronotum .32 in.; elytra .55 in.; femur .95 in.; tibia .80 in. *Male.* Length .87 in.; pronotum .25 in.; elytra .55 in.; femur .62 in.; tibia .56 in.

*Hab.* South Colorado and New Mexico, from Cañon City south, near the mountains; mostly in the narrow valleys behind the first range of parallel hills called "Hog-backs."

**B. FLAVO-FASCIATUM, nov. sp.**

Very much like *B. nigrum* in size and carving.

*Female.* Central foveola of vertex very shallow, divided into two parts by a median carina; frontal ridge convex, sparsely punctured. Pronotum differs from previous species only in having the transverse incisions less distinct.

*Color (siccus).* Yellow varied with brown. Head yellow; lower angles of the face black; a very distinct yellow line, starting from the upper corner of each eye, reaches the posterior margin of the pronotum, bowing inward near the middle, bordered on each side by an irregular dark brown line; a dark line borders each eye posteriorly. Median carina of the pronotum dark brown or piceous-black; the transverse incision black; rest of the pronotum brownish, palest on the sides. Elytra formed as in *B. nigrum*, brown, a pale yellow stripe near the upper and lower margins of each, the upper divided near the base; three oblong yellow spots in a line along the middle, and a few smaller spots near the apex; reach the third abdominal segment. Wings transparent, dusky at the tips. A brown stripe along each side of the abdomen, near the dorsum; a yellow spot in it on each segment near the upper border. Venter yellow.

*Male.* Unknown.

*Dimensions.* *Female.* Length 1.5 in.; pronotum .38 in.; elytra .50 in.;

opteryx. The second comprises the Struthious, or Ostrich family. The third embraces all the remaining existing birds. To this last he gives the name Carinatae.

The Carinatae he subdivides into four sub-orders, namely, the Dromæognathæ, which have the Cassowaries as their type; the Schizognathæ, which are "characterized not only by the complete distinctness of the maxillo-palatines from one another and from the vomer, but by the slender and usually pointed form of the latter bone." The third suborder are the Desmognathæ. In these the maxillo-palatines unite with one another in the median line, thus filling up or bridging over the space which exists as a fissure in the Schizognathæ. The fourth suborder, the Ægithognathæ, "have a palatine structure, which is, in some respects, intermediate between that of the Schizognathous and that of the Desmognathous groups, while in others it is peculiar."

This introduction was deemed necessary in order to render intelligible the remarks which are to follow.

#### SCHIZOGNATHÆ.

This suborder is divided into six groups, named, respectively, the Charadriomorphæ, or Plover-form; the Geranomorphæ, or Crane-form; the Cecomorphæ, or Gull-form; the Spheniscomorphæ, or Penguin-form; the Alektoromorphæ, or Cock-form; and the Peristeromorphæ, or Dove-form.

In the group Cecomorphæ, Mr. Huxley states that the "*Procellaria gigantea* alone has presented basipterygoid processes." He had not been able to observe them in other Procellariidæ. I have come to the conclusion, from this statement, that his observations must have been limited to *Procellaria gigantea* and to the Diomedeinæ, else he could not have failed to observe them. The following are the species belonging to the Procellariinæ which were examined by me: *Procellaria gigantea*, *P. glacialis*, *P. glacialisoides*, *P. Lessonii*, *P. capensis*, *P. mollis*; *Puffinus tenuirostris*, *Puf. fuliginosus*, *Puf. Anglorum*; *Prion vittata*, and *Thalassidroma Leachii*. In all of these the basipterygoid processes were present, and well developed (except in *Thalassidroma*, where they were rudimentary), articulating with the pterygoid bones.

From the species examined it will be seen that the possession of these processes is characteristic of the subfamily. Their presence is the rule rather than the exception. Their absence is rather the exception. This fact is sufficient I think to justify a separation of them from the other Cecomorphæ, and to make a separate group of them under the name of Nectriomorphæ.

The Nectriomorphæ may be looked upon as an intermediate group, connecting the Cecomorphæ (which contains the Laridæ, the Columbidae, the Alcidæ, and the Diomedeinæ) and the Charadriomorphæ (which contains the Charadriadæ and Scolopacidæ).

The presence of the basipterygoid processes allies it with the latter.\* Its lamellar and concavo-convex maxillo-palatines is a feature common to both, but more characteristic of the Charadriomorphæ. The absence of the recurved process at the angle of the mandible connects it with the Cecomorphæ.

The vomer in Nectriomorphæ differs from that found in either of the two groups mentioned above. In these latter it is forked posteriorly, and embraces the basisphenoidal rostrum on each side. In most of the Cecomorphæ a boat-shaped fossa is left between the divergent posterior ends of the vomer. In Diomedeinæ the sides are more or less pressed together, obliterating the fossa. The vomer tapers to a point anteriorly. The upper portion of it is flattened

---

\* In *Glareola orientalis* the basipterygoid processes are absent. The maxillo-palatines are less lamellar than those found in the other Charadriomorphæ. The vomer is cleft posteriorly, but slender and rod-like anteriorly. The angle of the mandible presents the recurved process which is characteristic of the group.

This genus is evidently an aberrant form, but in which direction it inclines I am not prepared to say.

out horizontally, while the lower portion is vertical in direction, and scythe-shaped. This form of the bone may be more or less modified. It is not confined altogether to these groups.

In Nectriomorphæ the sides of the scaphoid fossa are flattened down, and the whole bone is compressed horizontally. It is somewhat tongue-shaped.

The group Geranomorphæ is not so well defined as the Charadriomorphæ and Cecomorphæ. It is represented by the Rallidæ, by the Psophinæ and Gruinæ of the family Ardeidæ, and by Otididæ of the Struthionidæ.

The following are the characteristics of the group, as given by Huxley:

"The rostrum is relatively stronger than in the preceding group (Charadriomorphæ), and may even be short and arched.

"The basipterygoid processes are absent (ex. *Grus antigone*).

"The maxillo-palatines are concave-convex and lamellar.

"The angle of the mandible is truncated.

"In the typical groups the sternum is comparatively narrow and elongated, and may be deeply notched or entire."

In that portion of the article where he considered the cranial characters alone, he states that the Rails are always devoid of basipterygoid processes.

I found them to exist only in *Ortygometra porzana*,\* where they are well developed.

In addition to the sternal characters mentioned, I may state the following: From the situation of the principal pneumatic foramen on the internal surface of the sternum there rises a ridge which is produced upward to the anterior border, where it becomes forked or branched, and may present either a Y- or T-shaped appearance. In the former case it looks very much like the bifurcated manubrium of the true Passerine birds. It was present in all the representatives of this group examined,† except *Fulica* and *Otis*.

In all of the Rails and in some of the others there is a small process produced upward from the symphysis between the clavicles. This is a character which is constant in the Herons. Its presence in the Rails shows an inclination towards the Ardeinæ.

In Alektoromorphæ,‡ or Cock-form, "the rostrum may be slender and depressed, or high and arched. Oval, flattened basipterygoid facets, sessile upon the basisphenoidal rostrum and articulating with corresponding surfaces upon the pterygoids, are always present. The maxillo-palatines are always lamellar, but vary greatly in size, being sometimes very small.

\* The palatine bones are relatively long and narrow, with obsolete internal lamellæ, and the... of the... angles.

The basipterygoid processes are situated, like those in Columbidae, at the juncture of the basisphenoidal rostrum with the body of the sphenoid. As in the Doves, they are prominent and articulate with the pterygoids about midway between their anterior and posterior ends; while in the Alektoromorphæ they are flattened facets, sessile upon the rostrum, and articulate with the pterygoid bones near their anterior extremity. The other cranial characters resemble the Cocks.

The sternum is almost completely Peristeromorphie. The inner posterior notch on each side is converted into a foramen; the outer is wide and deep; both of which are Dove characters. The anterior inferior angle of the keel is less produced forward. In this particular it is like the walking birds.

In all the Gallinaceous birds examined the clavicles presented a large, broad process, which is developed downward from the summit of their symphysis. In the Doves it is wanting, as it also is in *Pterocles arenarius*.

On the whole, I think that it approaches the Peristeromorphæ more closely than the Alektoromorphæ.

#### DESMOGNATHÆ.

The third suborder, Desmognathæ, is divided into seven groups. They are named the Chenomorphæ, or Goose-form; the Amphimorphæ, a type intervening between the Goose and Stork form; the Pelargomorphæ, or Stork-form; the Dysporomorphæ, which have the Gannets as their type; Ætomorphæ, or Eagle-form; the Psittacomorphæ, or Parrot-form; the Coccoygomorphæ, or Cuckoo-form; and the Celeomorphæ, or Woodpecker-form.

In the Chenomorphæ "the lachrymal region of the skull is remarkably long.

"The basisphenoidal rostrum has oval, sessile, basipterygoid facets.

"The flat and lamellar maxillo-palatines unite and form a bridge across the palate.

"The angle of the mandible is greatly produced and recurved.

"The sternum has a single pair of notches at its truncated posterior margin."

In this group Prof. Huxley places the *Palamedea*. The following are the peculiarities presented by the bones situated at the roof of the mouth in *Palamedes cornuta*. The maxillo-palatines are inflated. They unite with one another across the median line; but this union is not so extensive as that seen in the Anatidae. The bridge across the fissure is very narrow. The maxillo-palatines, anteriorly and posteriorly, are separated by a wide interval. The septum is entirely wanting, as it is in the Gallinaceous birds. Like this group, again, the anterior processes of the palatines are long and slender, and their posterior ends are rounded off. The posterior extremities of the palatines and the anterior extremities of the pterygoids do not articulate directly with the basisphenoidal rostrum, as stated by Huxley. A space, the tenth of an inch, intervenes between the rostrum and the upper surface of the palatines. The basipterygoid processes are long and prominent.

The lachrymal region of the skull is remarkably short. It presents the same condition in the Gallinæ.

The angle of the mandible is produced and recurved. This character exists as well in the Gallinæ as in the Anserine birds.

The sternum bears no resemblance either to the Gallinaceous birds or to the Anatidae. The external angles of the posterior extremity are produced more than the middle portion. A slight notch exists on one side. This backward extension of the postero-external angles of the sternum is characteristic also of the Albatrosses.

From the above description it will be seen that the *Palamedea cornuta* exhibits a decided resemblance to the Gallinaceous form. The closed palate should

not exclude it from the Alectoromorphæ; for the Cracidae show the same structure in this respect.

A bird may present characters which are analagous to those found in another bird of a different family without there necessarily being any affinity between them. This is doubtless the case between the *Palamedea* and *Anatida*.

The following two characters may be added to those already laid down as belonging to the *Ardea*. They will be found to be highly characteristic.

A rather long and well-developed process is produced upward from the symphysis between the clavicles. The second peculiarity is in the internal angles of the distal ends of the coracoids. They override one another. This last peculiarity was first pointed out to me by Prof. O. C. Marsh, of Yale College.

In Coccozygomorphæ, according to Prof. Huxley, "basipterygoid processes are present only in one genus (*Trogon*).

"The maxillo-palatines are usually more or less spongy. The palatines are not developed into vertical plates, but are, as usual, horizontally flattened.

"The sternum usually presents two notches on each side, and has no bifurcated manubrial process (ex. *Merops*).

"The clavicles are convex forward, and without any process developed backward from the summit of their symphysis."

Basipterygoid processes were found in *Priotelus temnurus*, of the family Trogonidae. They are present in *Turacus albocristatus*, of the Musophagide, but here they are rudimentary. They do not articulate with the pterygoids.

Huxley states that in *Merops* the "palatines are devoid of any postero-external elongations." In *Merops ægypticus*, *M. Leschenaultii* and *M. amicta* the postero-external elongations are quite prominent.

In *Psalopogon pyrolophus* and *Megalaima chrysopogon*, of the family Capitidae, the vomer presents an appearance which is somewhat singular. It is well developed. Its anterior extremity is bifurcated, and each prong of the forked end is produced to the maxillo-palatine process of the corresponding side, and becomes united with it. This form of the vomer is doubtless a family characteristic.

It was chiefly in the sternal characters that the members of the group Coccozygomorphæ were found to differ from the statements laid down by Mr. Huxley.

In all the members of the family Cuculidae examined,\* the clavicles presented a well-developed process at the summit of their symphysis. The

Aug. 2d, 1870.

MR. VAUX, Vice-President, in the Chair.

Twelve members present.

PROF. LEIDY exhibited in a vessel of water, numerous living specimens of a leech, which he said was abundant in the vicinity of Philadelphia, but appears to be an undescribed species. He had first observed it in a pond, on the Delaware, near Beverly, Burlington Co., N. J., from which he obtained the largest specimens. It was found especially beneath half-submerged dead limbs of trees, sometimes between the bark and wood, and in crevices and holes of the latter made by insects. It was also found in the Delaware and Schuylkill rivers near shore, beneath stones. In ditches below the city, and communicating with the rivers mentioned, smaller leeches, apparently the young of the same, were frequent between the leave sheaths of submerged stems of aquatic plants, such as *Zizania aquatica*, *Scirpus fluviatilis*, *Sagittaria*, *Sparganium*, &c. When disturbed, the animal receded from its position of rest, and swam rapidly like the ordinary medicinal leech, *Hirudo decora*. It appears to belong to a different genus from the latter, and approaches most in character *Nephelis*, though it even exhibits points of difference from this as ordinarily described. The more mature animal from the Beverly pond may thus be characterized:

Body elongated, flattened cylindroid, narrowing anteriorly, smooth, indistinctly annulated, margin acute, above blackish olivaceous, below translucent grayish, with a more or less reddish tinge due to the blood. No striæ or markings visible beneath, and the annuli in this position scarcely perceptible. Annuli about 98, above minutely punctated with yellowish olivaceous or dusky whitish, and narrowly defined by the same hue. Head continuous with the body, obtuse. Mouth large, obliquely terminal, subbilabiate; lower lip crenulate. Jaws three rudimental folds without teeth. Œsophagus capacious, with three longitudinal folds. Intestine simple. Anus dorsal, conspicuous, in the penultimate annulus. Eyes six; anterior pair largest and approximated: second pair in second annulus corresponding with the lower lip; third pair smallest, more deeply situated than the others, and placed slightly external and posterior to the second pair. Acetabulum terminal, inferior, circular, nearly as wide as the body. The larger male aperture conspicuous, and situated about one-fifth of the length of the body from the head; the smaller female aperture scarcely visible, and situated two or three annuli back of the former. Length to  $2\frac{1}{2}$  inches by two lines wide; by contraction becoming shorter and wider.

Smaller specimens, from half an inch to an inch in length, from the ditches communicating with the Delaware and Schuylkill Rivers, and from the latter, agree in form and constitution with the preceding, having the same number of annuli to the body, and the same number and disposition of the eyes. The color is translucent pale indian-red, passing into darker shades and without the colored punctæ. Some young pale individuals exhibit a few scattered minute black punctæ down the back, due to single pigment cells, but mostly these are absent. Intermediate sized individuals from the Delaware and Schuylkill exhibit a gradation of character between the two forms indicated. Further, numerous young from the ditches, kept in an aquarium for the last month, have gradually assumed the appearance of the more mature animal as first described.

*Nephelis vulgaris* of Europe has eight eyes; and the generative apertures are included between the 34th and 38th annuli. In the species above described I could detect but six eyes, and the annuli at the fore part of the body are too indistinctly defined to determine the exact relative position of the generative apertures.

The new species of *Nephelis* I would propose to name *N. PUNCTATA*.  
1870.]

I take the present opportunity of observing that yesterday, during a stroll in the meadows below the city, to procure specimens of the leech just described, I observed that many of the ditches, and several ponds, were teeming with the minute plant *Wolffia*, probably *W. Columbiana*, mingled with *Lemna polyrrhiza* and *L. minor*. In several places I also observed *Sirter polymorphus* swarming upon *Ceratophyllum demersum*, conspicuous by its bright pea-green hue upon the darker hue of the latter plant. In similar positions I also observed an abundance of *Volvox globator*. This latter I have frequently seen in the vicinity of our city, and, preserved in an aquarium, have observed it pass through the various stages representing what were formerly viewed as distinct species under the names of *V. curvus* and *V. stellatus*.

In the course of my walk, I noticed upon the margin of a ditch a large mass of jelly, about two feet in breadth and about two inches in thickness, the character of which I at first did not recognize. It reminded me of the jelly-fish or medusa (*Cyanea erctica*), so frequently seen stranded on the ocean shore of New Jersey. A nearer inspection proved it to be a mass of the remarkable compound ciliated fresh-water polyp, or polyzoon, formerly described by me under the name of *Pectinatella magnifica*, which had, by an unusual recedence of the tide, been left to die on shore. On examining the ditch in the vicinity, I observed many masses of the same polyp, varying from the size of one's fist to that of a boy's head, mostly attached to the pendent leaves of aquatic plants growing at the margins of the ditch.

PROF. COPE called attention to a large specimen of a *Trigonocephalus*, of which some fourteen inches was enclosed in the oesophagus and stomach of a larger *Oxyrrhopus plumbeus*. The specimens were from the island of St Lucia, W. I. He stated that a species not distantly related to the latter (*Ophibolus getulus*) was said to have a similar habit of devouring our native *Crotalids*. The islands of Martinique and Guadeloupe had become so infested with the fer-de-lance, *Trigonocephalus leucocephalus*, as to be in parts almost uninhabitable, and that it was chiefly on account of the danger from this venomous reptile that collecting naturalists had of late years so seldom visited them. The annual number of deaths in Martinique from this cause was said to be very large. Some means had been adopted to check the increase of this pest, but with small results. Prof. Cope thought that as the *Oxyrrhopus plumbeus* was very numerous in Venezuela and Brazil, and since it was very harmless and easily procured, that its introduction in large numbers into Martinique, etc., would be a simple matter, and one probably to be attended with good results in the diminution at least, of this enemy of agriculture.

MR. J. H. REDFIELD remarked that, on a recent visit to the northern part of the State of New York, he had noted the *Botrychium lunarioides* and *Botrychium lanceolatum* growing under circumstances that seemed to confirm the idea that these species are really underground parasites, or *epiphytic* plants. More than twenty plants were noticed scattered over a space of a mile in length, and in every instance they were growing near the common blackberry (*Rubus villosus*), and every plant that was lifted had its roots in contact with the root of the blackberry. He referred to the peculiar character of the root of this genus,—so different from that of other ferns, and so similar to that of some orchids,—and to the fact that these species, so widely distributed, seem nowhere abundant,—as favoring the idea of their epiphytic character. Mr. Newman some years ago expressed the opinion that the British *Botrychium lunaria* is an underground parasite, but Moore and others have doubted. Mr. R. desired to call the attention of botanists to the conditions under which these and other species of *Botrychium* may be found, with a view to determine the question.

---

Aug. 9th.

MR. VAUX, Vice-President, in the Chair.

Fifteen members present.

The following paper was presented for publication:

“On some new species of Fishes obtained by Prof. Orton from the Maranon River, Upper Amazon and Napo Rivers.” By Theo. Gill.

MR. THOMAS MEKHAN said very little had been written about the causes of those bunches of branches often seen in trees, and called by the people “crow’s nests,” and by botanists *fasciations*. Dr. Masters, in *Teratology*, briefly refers to them, and refers to “over-nutrition” the cause of their existence. He had watched almost daily the past year one of *Abies balsamea* on his own grounds. The branchlets were weak, the leaves were comparatively long and slender, not distichously arranged, pale in color, deciduous, and many of the branchlets died in the winter. All these were evidences of weak nutrition.

He had found two trees of sassafras, apparently of the same age, growing within a few yards of each other, but one with numerous fasciculated bunches. In addition to the characters in the other case, here the fasciculated tree was not as large as the other one.

That weakness, not strength, was the cause, was also proved by facts from an opposite direction,—namely, the law of sex. He had already shown that a low condition of vitality favored male, at the expense of the female organs. He had found a large number of fasciculations in the common blackberry, and in all instances, besides the yellowness and the other marks, there was a tendency to abortion in the pistils, an increase in the number of petals, and a development of foliaceous points to the usual calyx segments. So that his law of sex, as well as the usual phenomena of weakened vitality, indicated that it was this and not over-nutrition which caused fasciations in trees.

---

Aug. 16th.

MR. VAUX, Vice-President, in the Chair.

Seven members present.

---

Aug. 30th.

The President, DR. RUSCHENBERGER, in the Chair.

Fifteen members present.

1870.]

On favorable report of the Committee, the following paper was ordered to be published:

On some New Species of FISHES obtained by Prof. Orton from the Marañon, or Upper Amazon, and Napo Rivers.

BY THEODORE GILL, M. D., PH. D.

In an expedition to the Andes of Ecuador and Peru, and thence across the continent of South America, under the command of Prof. James Orton, a considerable zoological collection was formed, and the fishes being submitted to the writer for determination, the following appeared to be undescribed. Of previously known species, the most noteworthy were *Chalcinus nematurus* Kner, *Gasterosteus stellatus* Kner, *Pimelotrops lateral* Gill, and *Cyclopius Humboldtii* Swains.

#### Subfamily TETRAGONOPTERINÆ.

TETRAGONOPTERUS ORTONI Gill.

D. 11. A. 34. L. 1. 31.

The height is contained about twice in the distance between the snout and the median margin of the caudal, and the head about four times in the same, or three and a half in the length, exclusive of the caudal. The profile is concave at the parietal region; the interorbital area is transversely convex. The diameter of the eye is contained two and a half times in the head's length. The supramaxillary extends nearly to the vertical of the anterior margin of the pupil. The dorsal is immediately behind the roots of the ventrals; its height equals about  $\frac{1}{3}$  of that of the body. The pectoral equals  $\frac{1}{2}$  the length of the head; the ventrals extend to the anal.

The scapular spot is indistinct; that at the base of the caudal well defined.

Most nearly related to *T. orbicularis* Val.

I dedicate this species to Prof. Orton.

ASTYANAX CAROLINÆ Gill.

D. 11. A. 26. V. 9. L. lat.  $37\frac{6}{5}$ — $38\frac{6}{5}$ .

The height of the body enters  $2\frac{1}{2}$  times in the length, exclusive of the caudal; the length of the head  $3\frac{1}{2}$ ; the profile to the convex snout is rectilinear.

dal; the head three and a half times. The eyes are large, the diameter being contained only three and a half times in the length of the head. The supra-maxillary ends under the posterior border of the pupil. The surface of the intermaxillary has four larger equidistant conical teeth, directed forwards, and a smaller one on each side and farther back, between the external and internal; the surface of the mandible has also four conical processes. The dorsal commences nearly over the anus; its height at least equals three fourths of the head's length.\* The anal commences nearly under the third dorsal ray. The pectorals extend beyond the anus, and the ventrals, which are inserted nearly midway between the axils of the pectorals and the origin of the anal, extend to about the third ray of the latter.

The scapular spot is very distinct; the caudal indistinct. The fins, especially the pectorals, minutely punctuated between the rays.

I dedicate this specimen to Mr. Philip V. Myers, a travelling companion of Prof. Orton, in compliance with a request of the latter gentleman.

#### HYDROLYCUS COPEI, Gill.

D. 11. A. 43.

The height enters  $2\frac{1}{2}$  times in the length (exclusive of the caudal), the length of the head  $3\frac{1}{2}$ ; the profile between the nape and convex snout is moderately incurved; the interorbital space is slightly arched, and about equal to the orbit, the snout, and a quarter of the head's length. The maxillary passes considerably behind the vertical of the posterior border of the orbit. The dorsal fin commences above the anus. The pectorals pass for a third of their own length beyond the axillæ of the ventrals, and the ventrals extend backwards to the third or fourth anal ray.

The lateral spot is faint, and above the lateral line, just in advance of the vertical of the anus.

Four specimens, the largest of which is four and a quarter inches long, were obtained in the Napo and Marañon rivers.

I dedicate this species to my esteemed friend, Prof. Cope, in recognition of his important contributions to herpetology and ichthyology.

#### Subfamily SERRASALMONINÆ.

##### PYGOCENTRUS ALTUS Gill.

P. 17. V. 7. D. 17. A. 33.

The height of the body is contained about 3 4-5ths in the length, exclusive of the caudal; the length of the head (measured from the prominent lower jaw) about  $2\frac{3}{4}$ . The back declines very slowly towards the nape of the neck, and thence is boldly decurved downwards. Snout obtuse, less than the diameter of the eye. The diameter of the eye equals a fifth of the head's length, and the interorbital width enters  $2\frac{1}{2}$  in the same distance. The second sub-orbital bone is separated from the preoperculum by a lunate naked area. There are fourteen teeth in each jaw. The origin of the dorsal fin is nearer the eye than the root of the caudal; its height is less than half the head's length. The origin of the anal is under the last dorsal rays. The pectorals scarcely reach the bases of the ventrals; the latter are two thirds as long as the former. Gill-rakers of the outer branchial arch short and pointed like those of the other arches. Abdomen armed with about twenty-seven serratures.

The color is greyish, iridescent, and tinged with blueish; there is no well defined scapular spot, but the region above the operculum is darker.

Nearly related to *P. scapularis* (*Serrasalmo scapularis* *Gthr.* v. p. 368).

---

\* The anterior dorsal rays are broken.

Family *SILURIDÆ*.Subfamily *PIMELODINÆ*.*RHAMDIA DORSALIS* Gill.

B. 6. P. I. 8. V. 6. D. I. 6. A. 9.

The body is moderately slender; the height rather exceeding a fifth of the length (exclusive of the caudal), while the height of the caudal peduncle is about an eleventh. The head forms rather more than a fourth of the length, and is about three fourths as wide as long, or more than twice as wide as the interocular area; the skin is moderately thick and smooth; and the suprascapital spine is pointed and extends beyond the vertical of the bony opercular margin. The eyes enter about eight times in the head's length, are entirely in the anterior half of the head, and are about equally distant from each other and the middle of the upper jaw. The upper jaw projects but little beyond the lower. The intermaxillary band of teeth is widest near the angles, where it is truncated and obtusely angulated, and rather narrowest at the middle; the greatest width exceeds a sixth of the length. The intramandibular flaps are considerably wider than the dentigerous bands. The maxillary barbel extend to or beyond the middle of the ventrals; the external mandibular extend beyond, and the internal nearly to, a line with the bases of the pectorals.

The dorsal fin is oblong, the longest rays equalling the distance from the second to the axilla. The adipose fin is contained between three and four times the length. The pectorals terminate under the second or third dorsal ray, and are not much larger than the ventrals. The porus axillaris is very minute.

The color is dark brown. The dorsal has the usual broad clear basal band

*SOBESIMICHTHYS ORTONI* Gill.

B. 14, 14 D. I. 6. A. 13. C. III, I, 7, 8, I, iv. P. I. 10. V. 6.

The head forms rather more than a third of the length, exclusive of the caudal fin; the outline above is oblong, convex in front; the width is less than half its length, and the width between the orbits less than a third; the hinder margin of the orbit is midway between the snout and opercular flap; the profile is perfectly straight. The dentigerous area of the upper jaw projects almost entirely beyond the lower jaw, and equals the chin or two diameters of the orbit; it is uninterrupted, except behind at the middle, where there is a broad but shallow triangular sinus; the palatal bands externally describe half an ellipse, and are only interrupted at the middle by a line of

may appear on re-examination of the latter, the dentition and other characteristics not yet being known.

*SCIADUS MARMORATUS* Gill.

B. 9. P. I. 10. V. I, 5. D. I, 10. A. 11.

The head is little longer than broad. The diameter of the eye is contained nine or ten times in the head's length. The vomerine teeth are in two oval patches, nearly as large as the eye, and separated by a moderately narrow interval; the palatine patches are transversely oval, and smaller than the pupil of the eye. The maxillary barbels extend beyond the base of the caudal; the external mandibular beyond the tips of the pectorals, and the internal beyond the bases of those fins. The dorsal fin is three fourths as high as the head is long. The adipose fin is half as long again as the dorsal.

The ground color is greyish, and forms meandering lines between the large blackish spots by which it is covered. All the fins are similarly colored, but the spots at the base of the dorsal are fused into a band. The barbels are indistinctly annulated.

Closely allied to *S. longibarbis* (Arius? *longibarbis* *Castlenau*), but appears to be distinguished by the longer adipose fin and the number of rays; it may, however, prove to be only a form of that species. *Castelnau* has doubtless overlooked the two small areas of teeth on the palate.

Subfamily CETOPSINÆ.

*CETOPSIS VENTRALIS* Gill.

P. 10. V. 6. D. 1, 6. A. 29.

The greatest height enters  $4\frac{1}{2}$  times in the length exclusive of the caudal, and  $5\frac{1}{2}$  times inclusive thereof. The head enters  $4\frac{1}{2}$  times in the length exclusive of the caudal fin, and  $5\frac{1}{2}$  inclusive of it; its breadth does not exceed half its length. The gape is continued under the entire eye. The teeth are in a villiform band on the lower as well as upper jaw, and on the vomer. The ventrals are inserted entirely behind the vertical of the dorsal, and are connected together by a membrane which is, however, closely connected with the abdomen along the middle, and is not free even at the margin; the extremities of the fins extend to or beyond the anus. The barbels are nearly equal and about two or three times as long as the diameter of the eye.

The color is greyish, darker above; the basal half of the dorsal is punctulated with black.

This species is most closely related to *Cetopsis gobioides* Kner, but is distinguished by the more compressed head, posterior ventrals, and longer anal.\*

Subfamily TRACHELYOPTERINÆ.

*CENTROMOCHLUS STEINDACHNERI* Gill.

P. I, 7, D. I. 5. A. 7.

The greatest height equals two thirds of the length of the head, which itself enters about  $3\frac{3}{4}$  times in the total length, exclusive of the caudal. The eyes are moderately large, the diameter equalling a quarter of the head's length. The maxillary barbels are nearly coterminous with the elongated pectoral fins. The dorsal buckler behind is cordate, and its branches expand inwards and extend as far back as the third soft ray. The height of the dorsal is not much less than the head's length; its spine is obsoletely serrated behind. The pectorals equal nearly a third of the length, and do not reach the ventrals. The

---

\* The number of anal rays is not given by Kner, but the figure represents twenty-two. 1870.]

ventrals are inserted midway between the branchial apertures and the base of the caudal. The caudal is forked.

Color greyish, tinged with silvery on the sides.

The species is eminently distinguished from its congeners by the form of the dorsal buckler; it is most nearly related to *C. megalops*.

I dedicate this species to the meritorious ichthyologist and herpetologist Dr. Franz Steindachner, as a slight recognition of his labors.

Sept. 6th.

MR. VAUX, Vice-President, in the Chair.

Seventeen members present.

The following paper was presented for publication :

"Notice of some Crustaceans of the Genus *Libinia*, with descriptions of three new species." By T. Hale Streets.

PROF. LEROY stated that he had just returned from a short visit to Boston and Cambridge, and that while there he had had the opportunity of examining the collection of Mastodon remains of the Warren museum and the Cambridge University museum, which had so much interested him, that he thought a brief notice of them would be interesting to the members.

The private museum of the late Dr. Warren, now in possession of his heirs, contains a magnificent skeleton of the American Mastodon (*M. americanus*), the best preserved and most complete which has yet been found. It was discovered in 1845, at Newburgh, N. Y. It is that of a mature male. The jaws contain the last two molars on both sides, besides the tusks above, and one of those below, together with the alveolus of that of the opposite side. This skeleton forms the basis of Warren's book on the Mastodon, published in 1852.

Besides the skeleton indicated, Dr. Warren's museum contains the skull of another, a well preserved specimen, found in Orange Co., N. Y. It is even larger than that of the skeleton, and also pertained to a mature male. The jaws contain on both sides the last two molars; and on one side the fourth molar is also retained. The specimen is described and figured in Warren's book on the Mastodon. (Pls. xvi, xviii, xix.)

The Warren collection further contains a number of other remains of Mastodon, mainly fragments of jaws with teeth, isolated molars, and casts in plaster of others. I may add it also contains a number of molars of the

specimen. The jaws contain the third and fourth molars in functional position. The fifth molar had not protruded and is visible within the jaws. The alveoli of the second molars are partially obliterated, and this is the case also with the inferior incisive alveoli. (Represented in pls. iii, iv, xvii, of Warren's book.)

4. A lower jaw of a quite young animal. It contains the first, second, and third molars in functional position and but little worn. The crown of the first molar has two transverse divisions; that of the second, two principal transverse divisions and a less well developed or rudimental third division; that of the third molar has three divisions. Large sockets for incisive tusks occupy the sides of the symphysis. (The specimen is represented in plate ii of Dr. Warren's work.)

An examination of many specimens of jaws and teeth of the American Mastodon leads to a confirmation of the view that the dental series consists of an incisive tusk and six molars on each side of both jaws. Whether the usual upper tusks are preceded by a temporary pair has not been determined. Small lower tusks appear to belong to the young of both sexes, but are lost and their alveoli obliterated in the female, while one or both are frequently if not usually retained permanently by the male.

The molar teeth in the order of protrusion successively follow one another from behind, but none of the series of six appear to have vertical successors.

The young animal exhibits the anterior two and then three molars together with tusks in both jaws, in functional position. As the third and fourth molars assume a functional position the first and second are shed, and as the fifth molar protrudes the third is shed. With the functional existence of the fifth and sixth molars the fourth is shed. Finally, in the old animal the sixth or last molar may alone remain, though usually the fifth and sixth appear to have been retained to the last.

In the Museum of Comparative Zoology of Harvard College, Prof. Shaler exhibited some Mastodon and other vertebrate remains, the results of his explorations at Big-bone-lick, Ky. Prof. Shaler incidentally informed me that he had detected no evidences of glacial action in the latter region. He supposes that the specimens of teeth and tusks, the wearing off at the sides of which I formerly attributed to glacial action, probably had been imbedded in stiff clay in the pathway of Mastodons, to whose tread the wearing was due.

The collection contained a multitude of remains of the Bison, but these Prof. Shaler found more superficially than those of the Mastodon and Elephant, and not associated with them. With the remains of the latter two genera were also found those of *Bootherium cavifrons*, of which the collection contains a skull without the face. There were also found with these some remains of the Horse, and also the fragment of a lower jaw, which appeared to me to belong to the existing Domestic Hog.

In referring to *Bootherium* I may add that I had the opportunity of examining a skull of the recent Musk Ox, preserved in the Museum of the Natural History Society of Boston, the first complete skull of the animal I have ever seen. In this skull I observed that the lachrymal fossa in advance of the orbit is a shallow depression even less distinct than in the Sheep. In *Bootherium* it is a deep, well defined hemispherical depression, being as different from that of the recent Musk Ox as is that of the Deer.

In the same museum, besides a few Mastodon remains, I remarked several molars of the American Elephant, interesting from their size. One of them, apparently a last upper molar, is from Brazos R., Texas, and is of the coarse plated variety, corresponding with the *Elephas columbi* of Falconer. The triturating surface is flat, not terraced, ten inches by four and three quarter inches in extent, including the enveloping cementum, and also fourteen and a half worn lobes or double plates. Behind, are four additional unworn and less well developed lobes. The breadth of the tooth obliquely is thirteen inches; the depth posteriorly to the broken root, eight inches.

1870.]

THE HISTORY OF THE ALIENATION OF

THE LANDS OF THE CROWN IN THE REIGN OF  
HENRY THE FIRST. BY JOHN  
HALLAM, ESQ. OF THE BARR

LONDON: PRINTED BY J. JOHNSON, ST. PAULS CHURCH-YARD, 1781.

THE HISTORY OF THE ALIENATION OF  
THE LANDS OF THE CROWN IN THE REIGN OF  
HENRY THE FIRST. BY JOHN  
HALLAM, ESQ. OF THE BARR

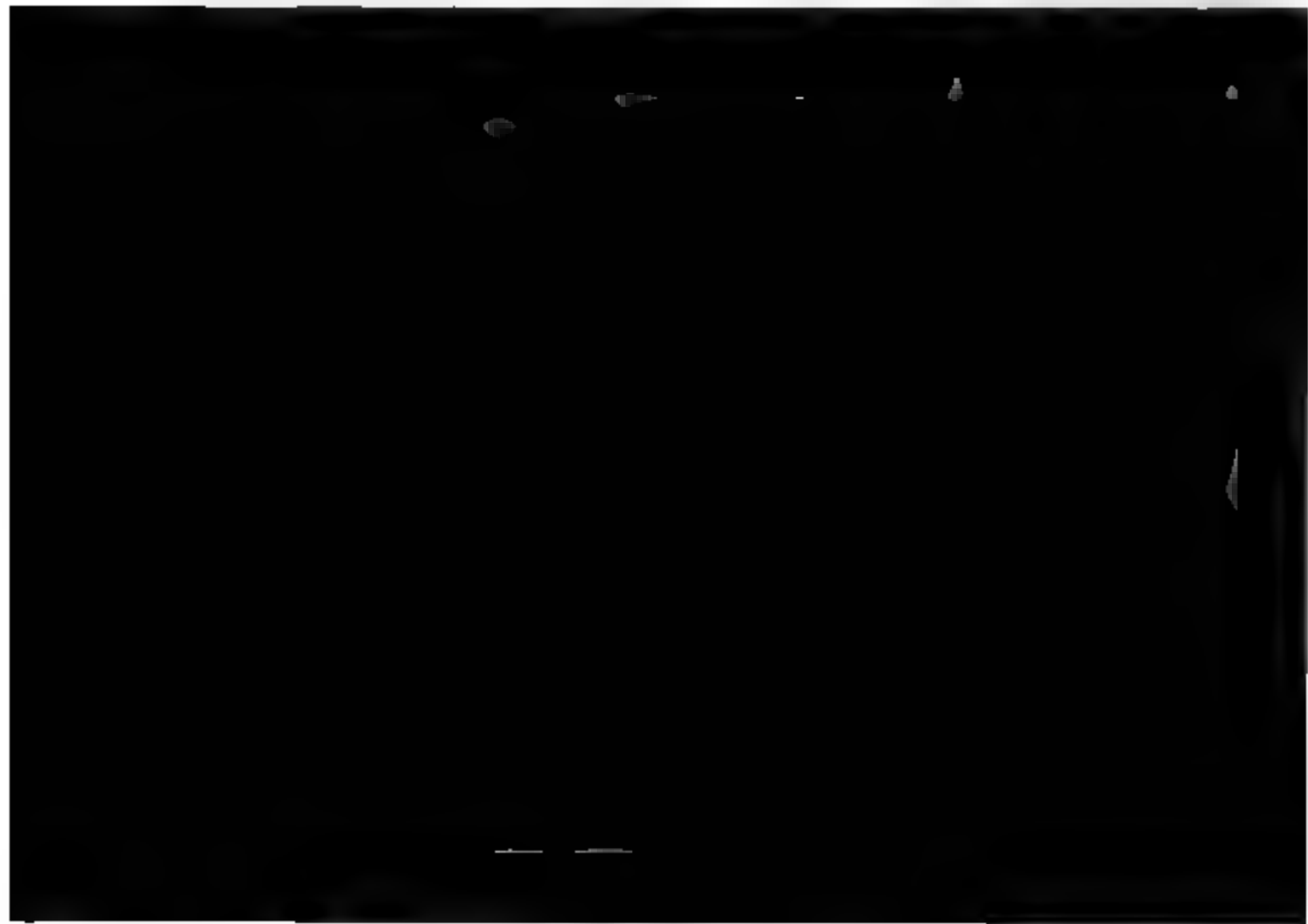
LONDON: PRINTED BY J. JOHNSON, ST. PAULS CHURCH-YARD, 1781.

THE HISTORY OF THE ALIENATION OF  
THE LANDS OF THE CROWN IN THE REIGN OF  
HENRY THE FIRST. BY JOHN  
HALLAM, ESQ. OF THE BARR

LONDON: PRINTED BY J. JOHNSON, ST. PAULS CHURCH-YARD, 1781.

THE HISTORY OF THE ALIENATION OF  
THE LANDS OF THE CROWN IN THE REIGN OF  
HENRY THE FIRST. BY JOHN  
HALLAM, ESQ. OF THE BARR

LONDON: PRINTED BY J. JOHNSON, ST. PAULS CHURCH-YARD, 1781.



the corresponding tooth of the American Mastodon, but is considerably smaller. It bears sufficient resemblance to the plaster cast (represented in fig. 14, pl. xxvii., of "The Extinct Mammalian Fauna of Dakota and Nebraska, &c.") of a tooth, the original of which is lost, from a miocene formation of Maryland, to be viewed as pertaining to the same species. This I had named *Mastodon obscurus*.

The crown of the tooth consists of four transverse divisions together with the merest trace of a heel. As in the cast of the Maryland tooth, the inner lobes of the crown of the California tooth are more mammillary, and less angular than in *M. Americanus*. The outer lobes, likewise as in the Maryland tooth, have better developed offsets fore and aft internally than in the latter, giving rise to a greater degree of obstruction of the transverse vallies of the crown than in the American Mastodon. The fourth division of the crown is proportionately less well developed, in comparison with those in advance, than in the latter, agreeing also in this respect with the Maryland tooth. The outer lobe of this division is formed of a pair of connate mammillary tubercles, as in the latter, but the tubercles are more equally developed. The inner lobe is a single mammillary eminence not more than half the elevation of the outer lobe. In the Maryland tooth, the corresponding lobe resembles the outer one, consisting of a connate pair of tubercles as well developed as in the outer lobe. The heel in the California tooth, as in the Maryland tooth, is formed by a short mammillary eminence occupying the angular space posteriorly of the lobes of the fourth division of the crown. A basal ridge is better developed externally in the California than in the Maryland tooth.

Comparative measurements of the California tooth, with the cast of the Maryland tooth, and one of the *Mastodon americanus* are as follows:

|   | California<br>tooth. | Maryland<br>tooth. | Mastodon<br>americanus. |
|---|----------------------|--------------------|-------------------------|
| Fore and aft diameter of the<br>crown of the last molar tooth | 6 in. 4 lines.       | 6 in. 4 lines.*    | 7 in. 3 lines.          |
| Transverse diameter of do.....                                | 2 in. 9 lines.       | 2 in. 9 lines.     | 3 in. 4 lines.          |
| Depth of do. internally.....                                  | 2 in. 2 lines.       | 2 in. 2 lines.     | 3 in. 0 lines.          |

It is not improbable that the California tooth may have pertained to the same species as the fragment of tusk previously noticed, and, perhaps these, together with the Maryland tooth, and others previously referred to *Mastodon obscurus* may likewise belong to the same animal. The positive determination of this question must be left for the discovery of additional material to throw light on the relationship of the different specimens which have been thus far presented to our notice.

Sept. 13th.

The President, DR. RUSCHENBERGER, in the Chair.

Twelve members present.

The following paper was presented for publication:

"On the flowers of *Aralia spinosa* and *Hedera helix*." By Thos. Meehan.

Sept. 20th.

The President, DR. RUSCHENBERGER, in the Chair.

Twenty-three members present.

---

\* Partially estimated, as the specimen is imperfect at its fore part.

Prof. Leidy exhibited the fragment of a jaw of a Crocodile, recently sent to him for examination by Prof. S. F. Henshaw, now engaged in geological explorations in part of the western territories. The specimen, together with a fragment of skull, fragments of bones, scales, and teeth of ganoid and other fishes, was found in the alluvium of the Big Sandy and Green River.

The fragment which is the jaw of the jaw illustrates an animal about the size of the alligator of the Mississippi, and apparently a head of nearly the same form. The external surface of the jaw is extremely rough and pitted. Two entire teeth and the remains of two others are retained in the specimen. The upper of the perfect teeth apparently forming the position corresponding with a canine, has a blunt point, which strongly curved fore and aft, and with the enamel finely ridged. The length of the crown is 4 lines; its diameter anterior-posteriorly 7½ lines, and transversely 4½ lines. The specimen pertains to an extinct species, probably different from any heretofore indicated. The character of the alluvial time which it was retained and its geological age I have not ascertained.

I propose to dedicate the species to Mr. Henry W. Elliott, a young and able artist, assistant to Prof. Henshaw's expedition, with the name of *Crocodylus Elliotti*.

Prof. Leidy stated that during the last summer he had made some further observations on *Trusella* a genus of minute polyps of the family Pedicellinidae, discovered by him some years ago. (*Tr. An. Nat. Sci. Coll. Phil.* 1854, 191) in the Rocky Mountain River. It is found abundantly below the dam at Fairmount, adhering to stones and rocks, in the stream and other part not in contact with the ground. Occasionally it is collected attached to the shell of the living *Corbicula* sp. and *M. lutea* sp. and was frequently to the stem of *Sagittaria* frutescens and the leaves of *Valeriana spiralis*. In the locality named, on the rocks, there may be observed in association with *Trusella*, the following animals: *Spizella* sp. which is very abundant and in compound numbers; *Corbicula* sp. parasitic on *Trusella* and *Lemna*; *Hydra* sp. Ag. *Palaemon* sp. *Stomatopoda* sp. and the worm *Monopoda* sp. etc.

Unlike the marine genera of Pedicellinidae, the polyp stocks of *Trusella* are erect or semi-erect, and not prostrate or creeping attached along the surface of bodies. *Trusella* starts by a thin membranous disk or expansion tightly adherent to the point of support. Usually two stems or stocks (occasionally three or only one, start from the same disk, and diverge from each other in a gentle curve. The stems may be seen from a simple pedicle with-

The internal structure of the polyps including that of the stems, bears a resemblance to that of *Pedicellina*, and will be more particularly described in a memoir preparing on the animal.

The youngest independent polyp stems of *Urnatella* consist of a simple cylindrical pedicle starting from the disk of attachment to the rock, and supporting a single polyp head. The pedicle elongates and divides into two segments. The ultimate segment grows in length and again divides; and in this manner all the segments are produced. After the production of three segments, the antepenultimate segment assumes the urn form. Budding commences from the second and third segments after their production, and from the succeeding segments, but not usually from the first segment. The buds originate from opposite sides of the base of the segments, and form branches of a single segment with a polyp head. The pedicle of these branches also frequently gives off a bud, which forms a secondary branch of the same kind as the primary ones.

In the longer *Urnatella* stocks, branches are usually observed only from the one two or three terminal segments. In the posterior urn-shaped segments, in the position in which branches emanate in the terminal segments, cup-shaped processes are observed. These were formerly mistaken for buds, but evidently result from the dehiscence or separation of branches, which leave the parent stock to establish colonies elsewhere. Though I have not observed this separation take place in *Urnatella*, yet all the points of structure appear to indicate that it actually takes place in the manner intimated.

It thus appears that the first step towards the multiplication of *Urnatella* is the segmentation of its stem. The segments put forth buds which develop polyps, and these then separate from the parent stock to settle elsewhere, and become the source of other series of polyps.

The ultimate history of the segmented polyp stock of *Urnatella* I have not ascertained. The stocks which I have preserved in an aquarium for several months finally lose their terminal polyps. Late in the season, also, all the polyp stocks which I could obtain on the river shore within the reach of my arm, at low tide, were deprived of their terminal polyps. The destruction of these, however, I have suspected to have been due to their having been uncovered in lower tides earlier in the season. I hope yet to be able to determine this question in the course of the next few weeks.

It has occurred to me that the segmented stems of *Urnatella* after the decay of the polyps, remained through the winter with little obvious change, and that in the following season, the segments served as reproductive bodies, in the same manner as the statoblasts in Plumatellidæ and their allies. This view is, however, not confirmed by specimens retained in the aquarium, and those collected on the edge of the river which had lost their polyps.

In relation to the production of ova, or the reproduction of *Urnatella* through sexual agency I have yet learned nothing.

Among the animals mentioned, as found in association with *Urnatella*, is the singular Annelide, *Manayunkia speciosa*, discovered by me some years ago, (Proc. A. N. S., 1858, 90.) The worm is closely allied to the marine genus *Fabricia*, and like it, lives in tubes constructed of mud. It is abundant in the locality indicated. Individuals of about two lines in length, are usually seen in a state of division near the middle into two. The anterior division of the body consists of five bristle-bearing annuli in addition to the head. The posterior division consists of six bristle-bearing annuli in addition to the partially developed head. The anterior head is provided with about thirty-six ciliated tentaculi supported on four lobes. It is also furnished with a pair of eyes; besides which the tentacle-bearing lobes exhibit a number of pigmentary spots, apparently of the nature of eyes. No eyes exist in the tail of *Manayunkia* as they do in *Fabricia*. The blood is green and is pumped intermittently into a large vessel occupying one tentacle on each side of the middle of the head.

1870.]

I have studied the development of *Monopneustes*, which will be fully described in a future memoir on the animal. Curiously enough the development of the young takes place within the tube of the parent, and the young remain in this position for a considerable time after their development. Thus I have obtained the young from the tube of the parent, after it was one-third of a line in length, and consisted of ten annuli, including the head, from which projected ten tentacles.

MR. THOMAS MEEHAN said that last year he had called the attention of the Academy to the fact that *Gymnocladus* and some other plants had a series of buds, not in the usual order of *Phyllotaxis*, accordant with the leaves, as we have believed axillary buds ought to be; but in a direct line, one above another; and that in those cases the upper bud, the one the farthest removed from the axil, was the strongest bud. He had overlooked the fact long known to botanists, until pointed out by Dr. Engelman, that *Lonicera* had this longitudinal string of buds; but in this case the largest bud was the one nearest the axil. He had since noted that these buds all followed the same law in this, that it was the large buds which had a flower-producing character, while the small ones were those which continued the axial growth.

By the help of this last observation he was now able to explain some facts in *Solanaceous* plants which he believed had not hitherto been understood. It was well known that many of these had a habit of producing their flower scapes at varying positions between the nodes, and not at the nodes, as is usual with most flowering plants. He exhibited specimens of the common Cherry Tomato, in which a few of the flower clusters sprang apparently opposite to a node, but the majority were at least one-fourth of the way down to the node below; also other species of the genus, in which the flower peduncle pushed out almost down to the lower axil. This was especially the case in some large plants, wherein the leaf axil, the axillary bud, and the bud producing the flower peduncle, were closely together in a direct line, as in *Gymnocladus*, before noted. The point to which he wished the particular attention of the members was that this internodular flower bud really belonged to the system of buds apparently originating at the node below.

He then showed that the flowering character of *Solanum* had a numerical law of its own. Every third node produced a flower spike or cluster. The node next following the flower had barely the rudiment of an axillary bud; the second one had a stronger bud; the third had a bud which in the Tomato and Eggplant pushed again into axillary growth, and had the axillary bud beyond, before noted—the flowering one. Other *Solanaceous* plants had similar characters, which, unless we remembered what we had learned in

ther investigation, but thought it quite likely, in spite of the hypogynous flower, *Phytolacca* would be found more nearly related to *Solanaceæ* than to *Chenopodiaceæ*, near which it was now placed.

He then exhibited some shoots of Grape Vine, and said that Dr. Engelman had pointed out, when at the Academy last year, that there was some numerical order in the tendrils of grape vines. In the specimen he exhibited every third node had no tendril; but he had seen some grape vines in which as many as eight nodes with tendrils had followed one another. In the mature wood, however, those without tendrils perfected the strongest buds. But he had found in the allied genus *Ampelopsis* a nearly regular system of buds and tendrils. In *A. hederacea*, the common Virginia or five-fingered creeper, the strong shoots running up a wall or tree had at every third node a strong axillary bud, *without any tendril*; while the two intervening nodes had tendrils *without axillary buds*. Occasionally, but very rarely, two successive nodes would have axillary buds, in which case the lower one would be smaller, and have also a small tendril on the opposite side. *Ampelopsis Vietchii* had the same character. He had attempted to propagate this by using nodes from which the tendrils pushed, as single bud cuttings, but failed to get any development from the axils. He believed they had not a trace of a bud in even the most rudimentary state. It had been said in Darwin's paper on motion in tendrils that the gland on the end of the tendril did not develop itself until it approached the object it was to cling to. In *Ampelopsis Vietchii*, they developed before this, in the shape of small globes, looking like rudiments of the same flower which ultimately appeared. In fact tendrils here were incipient flower branches, as any one could see by tracing the common *Ampelopsis hederacea* up to its final flowering condition, when, the axial growth ending in a terminal bud, instead of the usual lateral tendril, it seemed to erect itself and bear flowers. It would seem as if it was only by the elongation of the axis, demanding and drawing to itself nutriment which would otherwise go into the tendril, which made it a tendril, and not a flower shoot.

He did not, however, intend at this time to attempt any explanation of these series of observations. He thought there was nothing in any known law of *Phyllotaxis* which would explain them; and that by following them up matters of much interest to botany might be evolved. But, as he might have more to say about it some day, and winter was approaching, he thought to call the attention of the Academy to the facts, so that those interested might examine them for themselves before the frost destroyed the specimens.

The death of Mr. Wm. P. Wilstach was announced.

---

Sept. 27th.

The President, DR. RUSCHENBERGER, in the Chair.

Twenty-one members present.

The report of a Committee appointed to draft resolutions regarding the death of the late Wm. P. Wilstach was received, and the following Resolutions adopted:

The death of WILLIAM P. WILSTACH, at Saratoga, Sept. 17, 1870, has been announced to the Academy of Natural Sciences of Philadelphia.

Mr. WILSTACH during his connection of ten years with this institution has been distinguished among its members by his liberal, intelligent and prompt encouragement of every enterprise calculated to increase and diffuse knowledge of the Natural Sciences. Besides many donations at different times, he gave a thousand dollars towards the publication of the last volume of the Academy's Journal; a thousand dollars to the building fund, and in addition he made a conditional subscription of five thousand dollars to the same fund. These facts are cited in evidence of Mr. WILSTACH's interest in the progress of 1870.]

Science and culture;—they are among the reasons why the Academy recognizes in his death the loss of a liberal patron, a judicious counsellor and an agreeable associate.

*Resolved*, That this expression of the Academy's appreciation of Mr. WILSTON'S worth be communicated to his widow and family, in token of its sympathy with their bereavement.

W. S. W. RUSCHENBERGER,  
JOSEPH LEIDY,  
WM. S. VAUX.

(Signed)  
S. B. HOWELL, Rec. Sec.

The following gentlemen were elected members of the Academy: Green Smith, Thos. Stewardson, H. Weir Workman, W. B. Rogers, Thos. G. Gentry, Wm. H. Pancoast, M. D.

The following were elected correspondents: Prof. Igino Cocchi, of Florence, Italy; Prof. John Jas. Stevenson, Ph. D., of Morgantown, W. Va.

On favorable report of the Committees, the following papers were ordered to be published:

Notice of some Crustacea of the Genus *LIBINIA*, with descriptions of four new Species.

BY T. HALE STREETS.

Much uncertainty has existed with regard to the identity of certain species belonging to the genus *Libinia*. *Libinia dubia*, ever since it was first established by Milne Edwards, has been regarded as a doubtful species. In the description of it by Edwards, he states that it resembles *L. canaliculata* very much, and that it is not improbable that it is the young of that species. Naturalists in this branch of science down to the present time appear to have accepted this statement as the truth.

De Kay, in his Natural History of New York, states that the "younger individuals, 1—4 in. in length, are more pyriform in shape, are entirely covered with a dense, downy hair, and the spines are not so prominent as in the adult. In this state I suppose it to be the *L. dubia* of Edwards."

Gibbes in an article in the Proceedings of the American Association for 1850, regards the two species as distinct, but says that no absolute characters can be indicated by which they may be separated.

I do not know how to account for this prevailing ignorance, as the charac-

**Habitat.** Common species of the Southern Atlantic coast. Very common in the Delaware Bay. In the Academy's collection are four specimens from the coast of Long Island; and one from West Africa, by Duchailla.

*LIBINIA CANALICULATA*, Say. Jour. Acad. Nat. Sc. vol. 1, p. 77, pl. 4, fig. 1.

*L. emarginata*, Leach.

In the median line of the body, counting backward from the depression separating the stomach from the genital region, there is a row of five spines; one in the genital region, two in the cardiac and two in the intestinal. On the gastric region there is a longitudinal row of four spines. The second one counting from behind forward is generally double. The anterior one is situated in front of the transverse row, which contains four spines or tubercles, two on each side. The hepatic region always presents more than one spine, usually three, sometimes more; sometimes three on one side and two on the other. One large spine situated on the posterior part of the branchial region, on a line with the lower spine on the intestinal region, another smaller one intervening between. The whole surface of the carapax studded over with numerous spines and tubercles arranged more or less regularly. The spines on the lateral margin not as prominent as in *L. dubia*, but of the same number.

The cleft of the bifurcated extremity of the rostrum is very shallow. The teeth of the rostrum not on the same plane as in *L. dubia*, they present a direction downward. In the largest specimens the anterior extremity is considerably hooked.

The characters here enumerated as distinguishing *L. canaliculata* will be found to hold good through all variations of size—in those that are no more than an inch in length, as well as in those that are from four to five inches long, the latter being the largest of the kind that I have ever seen.

**Habitat.** Common to the North Atlantic coast, but extends down to the West Indies.

*LIBINIA AFFINIS*, Randell. Jour. Acad. Nat. Sc. vol. VIII, p. 107.

Gibbes says of this species that it "so closely resembles *L. dubia*, that if from the Atlantic coast, I should not regard it as different, but as it comes from Upper California I cannot venture to pronounce it the same."

The author here quoted undoubtedly made a mistake when he said that *L. affinis* closely resembles *L. dubia*. Stimpson approached the truth more nearly when he stated that "it is very closely allied to *L. canaliculata*." It is undoubtedly nothing more than the young of *canaliculata*. That it is so will be evident to any one who will take the trouble to compare them closely. It agrees with *L. canaliculata* in every respect excepting size.

*LIBINIA SURSPINOSA*, Streets, n. s.

Carapax pyriform. Regions distinct. Spines and tubercles few. Three small tubercles arranged transversely on the anterior portion of the gastric region, one on the median line and one on each side. On the posterior part of the stomach, in the usual situation of a spine or tubercle, there is a slight elevation. Genital region compressed from before backward. Two spines on the cardiac region, and one, rather large, on the intestinal region. Five spines on the lateral margin of the branchial region; the posterior one large. On the upper portion of the same region, near the superior border, are two more, arranged in a line from before backward. Hepatic region devoid of spines, smooth. Just beneath this region, on the antero-lateral border, are two spines, the anterior one large.

Rostrum prominent; teeth short and their apices directed forward and toward each other. A short obtuse spine projecting over the inner canthus of the eye. On the inferior border of the orbit are two small tubercles. External antennae cylindrical.

Anterior pair of feet shorter than the second. The fingers come in contact

along half the extent of their denticulated margins. The second pair of feet about the same length as the carapax, rostrum included.

The surface covered with close, short hair. Length of the body to the tip of the rostrum one inch and a half.

*Habitat*.—Chili.

(Cabinet Phila. Acad. Nat. Sci.)

*LIRINIA RHOMBOIDEA*, Streets, n. s.

Carapax nearly circular. Regions distinct; those in the median line of the body flattened. Six small but sharp spines on the gastric region; five arranged transversely on the anterior part. The two outer ones and the middle are larger, and are placed in a direct line with one another; the two intervening ones are smaller, and are situated a little in front of the others. One spine situated on the posterior part of the stomach. All the spines on the central regions small. Genital region quadrilateral and bearing a small spine. One on the cardiac region and one on the intestinal. On the posterior part of the cardiac region is an elevation which presents a depression in its summit. Four large and sharp spines on the branchial region independently of those on the lateral margin. These are placed so as to inclose a rhomboidal-shaped figure between them. A prominent spine on the hepatic region; five on the lateral margin. These with the one on the hepatic region form nearly half a circle. Below the lateral row anteriorly are two prominent spines.

A prominent spine above the inner canthus of the eye; a small one at the external canthus. External antennae cylindrical. A spine situated to the outer side of them, and one beneath directed downward.

Rostrum not so broad as in *L. dubia*, and its bifurcation less divergent, the teeth being directed nearly horizontally forward. Anterior pair of feet short and granular; a short spine on the lower portion of the arm. Second pair of feet nearly one and a half times as long as the body. Length of the body three inches and a half.

*Habitat*.—East Indies.

(Cabinet Phila. Acad. Nat. Sci.)

In the Academy's collection is a single specimen, which very much resembles the preceding, and in the absence of any others of the same kind to confirm the characters, I will not venture to call it a new species. The following are the chief points of difference. The regions in the median line of the body less depressed. The transverse row of spines on the anterior portion of the gastric region are arranged somewhat differently. The two lateral ones on each side are placed in a direct line while the middle one is situated a little

of the whole hand; denticulated along the whole length of their approximated margins. The third article of the second pair of feet flattened; that of the third pair less so. The same article of the fourth pair nearly cylindrical; that of the fifth pair cylindrical. This article is long, straight and inflated; largest diameter in the middle, gradually tapering anteriorly; no enlargement at the nodes. Hair on the body very short, scarcely discernable. Length of body about one inch.

This species can very readily be distinguished from *Peloplastus* (*Chionoecetes*) *Pellasi*, Gerstaecker. Unlike this the upper surfaces of the tibiae are not covered with short spines, and the double row of granules is wanting on the tarsi.

*C. Chilensis* may be distinguished from *C. Behringianus*, Stimpson, by the wart-like prominences not increasing in acuteness anteriorly and at the sides, except at the inferior antero-lateral margin. Here, instead of there being fourteen small bifid spines as in *C. Behringianus*, there are but eleven or twelve; the first five or six only being of any size. The third articles granular below as well as above. Only the inferior angles of the arms of the first pair of feet are mucronated.

*Habitat*.—Chili.

(Cabinet Phila. Acad. Nat. Sci.)

**HOXIA BIFURCATA**, Streets, n. s.

Carapax smooth, elongated, narrowing in front. Antero-lateral margins acute. On the gastric region three low tubercles arranged in a triangular form with the base of the triangle directed forward. A low tubercle on the cardiac region. The antero-lateral borders produced into sharp processes, directed forward, outward and slightly upward from the base of the rostrum. Rather broad lateral projections at the junction of the antero-lateral and postero-lateral borders, directed somewhat upward. These projections present two teeth at their extremities, separated by a concave interval. Postero-lateral borders rounded. Posterior border projecting backward lip-like, slightly overted on each side.

Rostrum about two-tenths of an inch in length; bifurcated at its point; flattened horizontally at the anterior extremity, which is on a lower plane than the base. Upper surface covered with hooked hairs. Under surface of the rostrum concave.

Eyes small, slightly projecting from under the lateral borders of the carapax. External antennae slender and completely concealed under the anterior prolongation. Basal article cylindrical, slightly clubbed at its anterior extremity; the second article more than half the length of the first; the third very delicate.

Anterior pair of feet about the same length as the carapax. On the distal extremity of the upper surface of the third article is a small tooth directed forward. Second pair of feet longer than the first pair,—about one inch in length. The following feet considerably shorter, and each presents a spine at about the middle of the under surface of the fifth article. Carapax, rostrum included, nine-tenths of an inch in length.

*Habitat*.—New Zealand.

(Cabinet Phila. Acad. Nat. Sci.)

### On the Flowers of *ARALIA SPINOSA*, L., and *HEDERA HELIX*, L.

BY THOMAS MEEHAN.

The study of *Aralia spinosa*, L., affords some interesting facts which do not seem to have attracted the attention of other observers.

In Dr. Gray's indispensable *Manual of Botany*, it is said to be "more or less polygamous." I have had many specimens under my daily observation 1870.]

this season, from the earliest opening till the last blossom appeared, and find that it is much more nearly monœcious than the above quotation would imply.

There are three different sets of flowers corresponding to the thrice compounded branchlets of the large panicle. When the flower scape elongates, it seems suddenly arrested at a given point, and a very strong umbel of *female* flowers appears at the apex. A great number of secondary branches appear along this main one; and they also suddenly terminate each with an umbel of female flowers. From these secondary branches a third series appear, and these flowers are well filled with anthers that are abundantly polleniferous. The female organs of these flowers of the third class, are, however, defective, as only a few bear capsules, and in these, a large portion of the seeds have no ovules. The polygamous character is confined to this third series of flower, the first two having purely pistillate blossoms. In these there do not seem to be the rudiments of stamens.

The most remarkable part of this process of development is, that the whole of this first series of female flowers should open so long before the male ones come, that they fall unfertilized. Most part of the second series also fall, and the crop of seeds is mainly made up of a few of the last opening ones of the section, and the comparatively few hermaphrodite ones which are found in those of the third class. It is a matter for curious speculation what special benefit it can be to the plant to spend so much force on the production of female flowers too early to mature, and then producing such an immense mass of pollen to go utterly to waste.

It may not be amiss to note, that in the common carrot the earlier strong umbels have often a male flower in the center; and that while the usual flowers are of a pure white, this one is of a crimson color. In the central umbels of *Aralia spinosa*, and at times on spurs along the branchlets of the panicle are similar colored processes, so small that their form cannot be made out by a common pocket lens. Our fellow member, Dr. J. Gibbons Hunt, makes them out, under the dissecting microscope, to be vase-like forms with five minute reflexed segments, and with a small solid disk in the centre. It is interesting as evidently being a successful attempt of an abortive flower to simulate in some respects a real one of another character.

Examining, also, the flowers of the allied European Evergreen Ivy, *Hedera Helix*, L., I find similar laws of distribution of the sexes as in *Aralia spinosa*, with the addition of a somewhat different structure in the male from the female flowers.

In Europe the plant is described as often having a single umbel as a flower spike. It is quite likely in these cases the flowers are hermaphrodite. In all the cases I have met here, the inflorescence is a compound of several

Oct. 4th.

The President, DR. RUSCHENBERGER, in the Chair.

Twenty-nine members present.

Prof. LEIDY directed attention to a small collection of fossils recently received from Prof. F. V. Hayden, now engaged in a geological exploration of part of our western territories.

Most of the fossils were collected on the Sweet Water R., eighteen miles west of Devil's Gate, Wyoming Territory.

The most numerous and characteristic remains in the collection are those of a species of *Merycochærus*, the skull of which was little more than two-thirds the diameter of that of *Merycochærus proprius* from the head waters of the Niobrara River. The species is particularly indicated by a number of fragments of jaws, with teeth of half a dozen individuals. The anatomical characters are the same as in *M. proprius*. The infra-orbital arch is of great proportionate depth, as in the latter when compared with its condition in the different species of *Oreodon*. The face has the same abruptly contracted character in advance of the orbits, and the infra-orbital foramen occupies a corresponding position as in *M. proprius*. In *Oreodon* the face narrows more gradually forward, and has a more triangular outline when viewed from above; and the infra-orbital foramen is situated farther forward. There may be other important anatomical points distinguishing *Merycochærus* from *Oreodon*, in portions of the skull of the former, which we have not yet had the opportunity of examining.

The inspection of these specimens leads me to suspect that the remains from the pliocene sands of the Niobrara River, which I referred to another genus under the name of *Merychys medius*, perhaps belong to the same animal, and those from the same locality referred to *Merychys major*, perhaps belong to *Merycochærus proprius*. The material at command is insufficient for me to determine whether this is the case, and under the circumstances I am disposed to refer the remains in question, from the Sweet Water R., to a distinct species with the name of *MERYCOCHÆRUS RUSTICUS*.

A series of lower molars of this species measures ..... 4 inches.

A series in another individual.....4½ inches.

The series in *M. proprius* is .....5½ inches.

It has occurred to me that the remains thus referred to a smaller species of *Merycochærus*, may have pertained to the female of *M. proprius*. The specimens, however, of all the individuals, indicate a smaller animal than those upon which the latter was founded.

In association with the remains are a few fragments indicating a small equine animal, perhaps a *Hipparion*. There are also several small fragments of jaws indicating the presence of *Canis vaser* and *Merycodus necatus*, originally based on specimens from the pliocene sands of the Niobrara River, Nebraska.

The remaining fossils consist of two interesting specimens, from near Fort Bridger. One of them is an upper back molar, apparently of a small species of *Lophiodon*. The crown of the tooth is perfect and but slightly worn at the acute summits of the lobes. The tooth has nearly the form, size, and constitution as the corresponding ones in *Anchitherium Bairdi*, but the ridges extending forward and outward from the inner lobes in advance of the outer lobes exhibit no trace of a disposition to form intervening lobes to the four principal ones. The fore and aft diameter of the specimen is a little over seven lines; the transverse diameter a little under that measurement. For the name of the species I would propose that of *LOPHIODON MODESTUS*.

The other specimen consists of a portion of the right ramus of a lower jaw of a small pachydermous animal, containing the true molars, much worn

together with the mutilated remains of the preceding premolar. The teeth are too much worn to enable me to determine the original anatomical characters, but nevertheless are sufficiently perfect to indicate an animal probably allied to the suilline family. The specimen belongs to a genus and species distinct from any heretofore met with by me from the North American geological formations, and, so far as I can make the comparison, appears different from any obtained elsewhere. I propose at present to refer it to a species with the name of *Hyopsodus paucus*, and in future will give a more detailed description of it accompanied with a drawing.

The length of the true molar series in the specimen is half an inch. The last molar is a little over two lines in its fore and aft diameter. The depth of the jaw below the second true molar is three and a half lines.

---

Oct. 11th.

The President, DR. RUSCHENBERGER, in the Chair.

Twenty-six members present.

The following papers were presented for publication :

"Observations on some fishes new to the American Fauna, from at Newport, R. I., by Samuel Powell." By Edward D. Cope.

"Note on *Silphium laciniatum*." By Thos. Meehan.

MR. THOMAS MEEHAN said he had noticed a singular habit in the common "Stink bug" of gardens, *Reduvius novemarius*, Say, which might lead to some important physiological discoveries by those more closely devoted to entomological studies. Wondering what made some abrasion on the bark of a *Percebra* on his grounds, he was attracted by a female insect of this species near it; and noticed that on the thigh of the middle leg the usual gray color was of a polished black. Supposing that possibly the insect may have had something to do with the injury to the bark, through which the turpentine was oozing, he waited a few minutes to re-assure the insect—usually time under observation—that there was no danger. It then went to work to take the turpentine with the heel of the tarsus of the fore leg, and place it on the thigh of the second leg. It took several dozen "heelfuls," winding it round the gathering ball on the leg, as one would wind a ball of string. After it had collected together a ball of turpentine about the size of a pin's head, it gradually wiped it off with the femora of the hind leg, and applied it to the anus, where it was very rapidly absorbed. It then walked very leisurely to the top of the

utaries and on both of its principal branches to their sources. Mr. Norris also remarked that the experiment was of much importance in ascertaining if this valuable fish—the salmon—may not be gradually acclimated in rivers further south than those they now frequent.

---

Oct. 18th.

The President, DR. RUSCHENBERGER, in the Chair.

Twenty-one members present.

PROF. LEIDY directed attention to a collection of fossils, recently received for examination, through the Smithsonian Institution, from Rev. Thomas Condon, of Dalles City, Oregon. The fossils consist of remains of mammalia, obtained by Mr. Condon from the valley of Bridge Creek, a tributary of John Day's River, Oregon. They appear petrified in the same manner as the similar remains from the Mauvaises Terres of White River, Dakota, but generally are less well preserved.

The greater number and more striking specimens belong apparently to a species of *Oreodon*, larger than any previously discovered and equaling in size *Merycochærus proprius*. Indeed, so far as we are familiar with the skull of both, the two are so nearly alike that one may be regarded as only a variety of the other, or at most both may be viewed as distinct species of the same genus. I am, however, disposed to view one as the offspring, by selection, of the other, and regard them as corresponding species of two genera which existed probably in different times or localities.

The species, which I propose to distinguish under the name of *OREODON SUPERBUS*, is indicated by a much mutilated skull, together with mutilated crania, and portions of jaws with and without teeth, of half a dozen or more individuals. The specimens indicate a little variation in the size of the animal, but it appears to have been on the average about the same as *Merycochærus proprius*.

The form and constitution of the cranium are the same as in *Oreodon Culbertsoni*, but large inflated ear capsules or tympanic bones exist as in *Oreodon major* and *O. bullatus*.

The face is intermediate in character to that of *Oreodon major* and *Merycochærus proprius*. It is rather more abruptly narrowed in advance of the orbits than in the former, but not to the same degree as in the latter. The infra-orbital arches are proportionately of much greater depth than in *Oreodon major*, and the other species of the Mauvaises Terres of Dakota, but are not so deep as in *Merycochærus proprius*. Thus in *Oreodon major* it measures 9 lines in depth, in *O. superbus* 18 lines, in *Merycochærus proprius* 23 lines.

The orbits are comparatively small, as in all the family of the Oreodonts. The lachrymal fossa is proportionately shallower than in *O. Culbertsoni* and *O. major*, and in this respect is more like that of *O. gracilis*.

The infra-orbital foramen in *Oreodon superbus* holds an intermediate position to that of *Merycochærus proprius* and that of the Mauvaises Terres Oreodons.

The jaws of *O. superbus* appear not quite so robust proportionately as in *Merycochærus proprius*, and the bone of the lower jaw is of less thickness.

The teeth of *O. superbus* and *Merycochærus proprius* agree in size and constitution, but the premolars and canines of the former appear more compressed laterally, or they are of less thickness from within outwardly, and are somewhat wider fore and aft.

I am prepared to admit that all the characters by which I have attempted to discriminate different species of *Oreodon* and *Merycochærus* are not fixed, but I nevertheless view them as sufficient to eliminate animals which would be generally recognised as distinct.

1870.]

The estimated length of the skull of *Oreodon superbis* is about fourteen inches. The length of the skull of *O. major* is about nine inches and one-third.

In a fragment of a lower jaw of *O. superbis*, imbedded in the matrix, the crown of the canine is an inch in width fore and aft. The three premolars behind occupy a space of two inches and a third. In *Merycochærus proprius* the crown of the lower canine is little more than three-fourths of an inch fore and aft, and the premolars behind occupy a space of less than two inches.

Of other remains in the Oregon collection there are a few fragments of jaws of *Oreodon Culbertsoni*, one of which contains a series of the upper last premolar and the true molars. There also occur a few small fragments of molar teeth, which are recognisable as pertaining to *Agriochærus antiquus*. There is also here an inferior true molar of *Leptomeryx Evansi*, and likewise there are several mutilated molars of *Anchitherium Bairdi*. These specimens are all marked as having been obtained from the "Big-bottom of the John Day."

An interesting specimen from Bridge Creek consists of a small fragment of an upper jaw, containing two teeth, apparently of a tapiroid animal, and probably the same as that indicated by a tooth from the Mauvaises Terres, and referred to a species with the name of *Lophiodon occidentalis*. The teeth appear to be the hinder two premolars, or perhaps are the last of these and the next true molar. They are much worn, and the second tooth has its back part broken off. They may belong to a different genus from *Lophiodon*, and they do exhibit slight peculiarity, but their condition renders a positive determination uncertain. The specimen indicates an animal about the size of the living *Tapirus terrestris*.

At least two species of *Rhinoceros* are indicated by remains from Bridge Creek valley. One of these I think to be the *Rhinoceros occidentalis*, originally founded on remains from the Mauvaises Terres of White River, Dakota. Several well preserved upper molars, and a fragment of the lower jaw with an entire molar, marked "John Day's," neither differ in constitution, form or size from those of the last named species.

An isolated upper molar, marked "Alkali Flat," clearly belongs to a different species from the former, and may perhaps pertain to the species *Rhinoceros Asperius*, founded on the ramus of a lower jaw from California. From the outer wall of the crown there project into the median valley three folds, and a small fold projects in the vicinity of the latter from the postero-internal lobe. The arrangement of these folds resembles that of a tapir or caribou molar.

was measured about eight lines, the transverse diameter about three-fourths of an inch.

Prof. LINDY further stated that in a recent visit to the Schuylkill river at Fairmount, to seek for specimens of *Urnatella*, though he had been unsuccessful in obtaining living ones within reach from the shore, he had found in the same positions occupied by the former, an abundance of *Cordylophora*. This is the first time that he had noticed this interesting compound hydroid polyp in the vicinity of Philadelphia, and he was surprised that until now it had escaped his notice. *Cordylophora* was first detected by him in this country at Newport, R. I. He had not been able to satisfy himself that it was a different species from the European *Cordylophora lacustris*, first described by Prof. Allman of Edinburgh. It appears, however, to be much smaller. Prof. Allman presents the *C. lacustris* several inches in length, with the polyps a line in length. Ours is not more than half the size. As a variety it might be named *Cordylophora americana*.

Oct. 25th

The President, DR. RUSCHENBERGER, in the Chair.

Twenty-four members present.

Prof. LINDY stated that he had recently received from Prof. Hayden, at the last date, at Fort Bridger, several boxes of fossils, most of them remains of Perodiles and Turtles from Church Buttes, the junction of the Big Sandy and Green Rivers, &c. Of these he proposed to give a notice at another period. Among the mammalian remains there were some of special interest, and to which he wished to direct attention at the present time. The first exhibited consisted of the crowns of teeth and fragments of others, of a pachydermous animal, approaching in size the common Ox. The crown of a lower true molar resembles in its constitution those of *Palæotherium*, *Chalicotherium* and *Titanotherium*, being composed of a pair of fore and aft conjoined pyramidal lobes with crescentic summits. It measures 16 lines antero-posteriorly and 10 lines transversely. Fragments of upper true molars exhibit the outer part of the crown composed of a pair of lobes exactly as in *Hyopotamus*. The inner portion of the crown is composed of a pair of simple cones, broad and low, the front one considerably larger than the back one. One of the specimens in the entire condition of the crown measured about 22 lines fore and aft and 18 lines transversely. The crown of an upper premolar has its outer part composed of a pair of conjoined cones with acute summits and sides. The inner portion of the crown consists of a single broad simple cone emplaced in front and behind by a basal ridge. The antero-posterior diameter of the crown externally measures  $9\frac{1}{2}$  lines; the transverse diameter is an inch.

The teeth indicate an animal apparently allied to *Chalicotherium* and *Titanotherium*, but different from either. The name of *PALÆOSYOPS PALUDOSUS* was proposed for it. The remains were obtained at Church Buttes, and belong, as Prof. Hayden reports, to the tertiary formation of the Bridger Group.

Another fossil exhibited was discovered by Prof. Hayden at Black's Fork.

It consists of a fragment of the lower jaw, containing two teeth, of an animal about as big as a Rabbit. The teeth, consisting of the two last molars, resemble in their construction those of the Peccary, but the constituent lobes of the crown are more pointed and smoother. The second true molar has four lobes: the last, an additional lobe. The two teeth together occupy a space of less than 5 lines; the depth of the jaw beneath the penultimate molar is three lines. For the animal, the name of *MICROSUS CUSPIDATUS* was proposed.

Another fossil consists of the greater part of the right ramus of a lower jaw partially imbedded in sandstone, and was also obtained by Prof. Hayden at 1870.]

Black's Fork. The specimen apparently indicates an animal allied to the Raccoon, than which it was nearly a third smaller in size. The ramus contained a series of seven molars, immediately succeeding the canine, without hiatus. All the molars remain except the first, and this like the succeeding one was inserted by a pair of fangs.

The teeth in the specimen are much worn, so that their original character is obscure. The crowns of the premolars appear to have been nearly like those of the Raccoon. In the true molars the postero-internal cusp of the crown existing in the latter, appears to have been but feebly developed in the extinct animal.

The body of the jaw, though much shorter, is absolutely deeper than in the Raccoon. The coronoid process has been comparatively narrow; the external masseteric fossa feeble, and the condyle is remarkably small, not being more than a third in size of that of the Raccoon.

The measurements of the specimen are as follow: length from symphysis to back of condyle,  $2\frac{1}{2}$  inches; space occupied by the series of seven molars, 16 lines; depth of lower jaw below the first true molar, 6 lines.

For the animal the name of *NOTHARCTUS TENEBROSUS* was proposed.

Remains of *Palæosyops paludosus*, have since been received from Henry's Fork of Green River, Wyoming.

The following gentlemen were elected members: Chas. K. Mills, M. D.; J. Solis Cohen, M. D.; Bushrod H. James, M. D., and Mr. J. Blodget Britton.

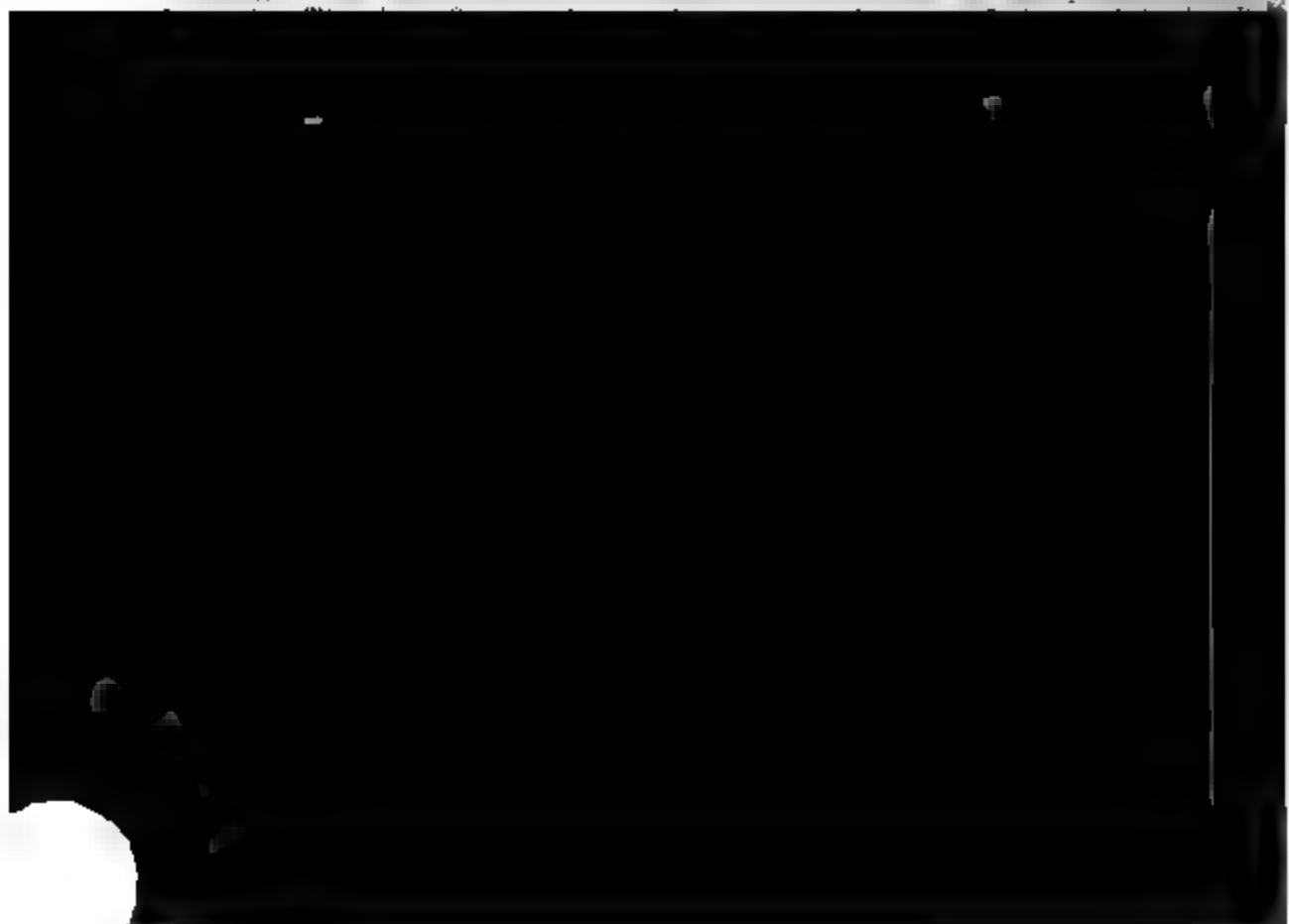
On favorable report of the Committees, the following papers were ordered to be published:

#### On the Stipules of *Magnolia* and *Liriodendron*.

BY THOMAS MEEHAN.

An examination of the stipules of *Magnolia* afford some highly interesting facts; most, or perhaps all of which are known to leading botanists, but which do not appear to be as generally known as they deserve to be; and which facts may have a more intimate bearing on many of the questions connected with the laws of development than is suspected.

In most species of *Magnolia* a scar peculiar to the genus exists on the petiole. This scar is elevated somewhat above the surrounding tissue, as if the matter forming it had been laid on the surface after the rest of the petiole had been



and they diverge and curve downwards just as these stipules do. Above these strong veins of the auricle are very weak veins, necessitating a very narrow blade portion there, until another set of strong veins push out and make the main part of the lamina.

If we press these auricles back against the petiole, and imagine an union with it, then a separation from the main leaf blade, and an union of the edges of the separated auricle, both above and below, we have a sheathed stipule exactly as we find them, and we see how easily *Magnolia Frazeri* might be a pinnate leaf of five leaflets on the supposition that the stipular portions really have taken the course we suppose these auricles might take.

I suppose no one of experience in living plants doubts the possibility of the adhesion of some parts and the separation of others, so as to make new parts or organs. If such is desired, I would refer to the *adhesion* of the carpellary leaves by their backs in the capsules of *Staphylea trifolia*; and for *separation* to the pinnate leaf often formed out of an entire blade in *Fraxinus excelsior*, *heterophylla*, and many other plants with entire leaves which often have pinnate ones amongst them.

It is scarcely possible, with these facts before us, to avoid the suspicion that the stipules of *Magnolia* are not formed like the stipules of most plants, which are perhaps leaf portions which have never been well developed, but rather are the tolerably well developed side pinnules of a trifoliate or deeply auricled leaf, which in an early stage had adnated with the petiole, and by their edges, and thus formed the stipular sheath we see. The suppositious case I have drawn from the auricles of *M. Frazeri* is still better illustrated by leaves of some Ranunculaceous plants. For instance, *Anemone Pennsylvanica*. Lay the lower lobes flat against the petiole, imagine the adnation by their backs, and cohesion of the edges, and we have the idea clearly.

It is difficult to conceive that these stipular sheathes could have been formed in harmony with all the appearances we have detailed, in any other way; but ideas and possibilities are not as good as direct facts. These are furnished in good part in other ways.

In the East Indian species, *M. fuscata*, the flowers are axillary, not terminal as in most other species. Three of the leaf axils on the growth of last year produce flowers. The lowest flower is the weakest, the upper the strongest. The bracts which enfold the flower buds are of course transformed leaves; and here, in these weak flowers, where the tendency of the vital course is almost as near to foliar organs as to floral parts, we find these leafy-looking bracts are trifoliate. The central lobe is composed of a short petiole, and a small oval leaf blade. Sometimes this attempt of the lower axil to produce a flower proves abortive. The already formed petals die away. In such cases the two lateral leaflets die away also, and the little miniature central leaf goes on and developes into one as large as the average on any part of the plant. But in the stronger flowers we find, just in proportion to their strength, the two lateral leaflets enlarge, and the central one diminish until at length it disappears, petiole and all. The laterals then *adhere by their edges*, become fleshy, and end in being petals. These are clearly seen to be formed out of the adnated lateral leaflets, which form the stipular sheaths in other cases, with the central of the trifoliate leaf type absorbed. This observation, in addition to the use I wish to make of it, confirms the views of some botanists, as I have learned from Professor Asa Gray, that it is by metamorphosis of the petiolar and stipular parts, rather than by modifications of the leaf blade, that petals are formed.

From these facts we gather the certainty of a trilobate type of leaf, and see the adnation of the edges; and only the dorsal adhesion to the petiole which I have shown so probable as almost to amount to a certainty, is left to be established by actual fact.

This ternate division of the leaf is a marked character in Ranunculaceæ, and with this exposition of a ternate type in Magnoliaceæ, its claim to a place  
1870.]

in the Rana alliance, strong as it always has been acknowledged to be, is still more strengthened.

It is impossible to suppose that a so closely allied genus as *Liriodendron* should be founded on a different type from *Magnolia*. We shall see that only very slight causes, which we can well understand, have made some of the chief foliar distinctions, and the few which we cannot prove from actual facts, can be made almost certainties from parallel observations. The identity of type will in this way be manifest.

First, as to the premorse or cut off appearance of the end of the leaf blade. This all results from the stipular portions being adnate with the stem axis, instead of being wholly on the petiole as in *Magnolia*. In the latter the stipules are carried along as the petiole advances, the leaf blade cannot grow beyond, and so in veneration has to lie flat up against them. In *Liriodendron*, the stipules being fast to the main stem, the petiole carries the leaf blade beyond them, over which it is bent until its apex is brought down in contact with the straight line formed by the union of stipule and stem. Here it is pressed as into a mould by the elongating petiole, and the form of the leaf which we see is the necessary result. These processes in *Magnolia* and *Liriodendron* can readily be seen on an examination of the buds at any time during the growing season; and to those who have no specimens the figure of the latter in Gray's *Genera* will easily give the idea. It may be here noted that those who look only to Mr. Darwin's principle of natural selection to account for the laws of form, might be troubled by such cases as these. It is scarcely conceivable that a square-edged leaf blade, as we find it in *Liriodendron*, is of any special benefit to the species; yet if this form is the consequence of some other act, which is a benefit, the selection principle may still hold.

If the ternate type of leaf is probable in *Liriodendron*, as in *Magnolia*, the lower portion of the petiole, and lateral or stipular portions, must have adnated with the stem prior to the full development of the leaf. This view necessitates the idea that the leaf does not always originate at the node from which it seems to spring. I do not believe it does; but I am well aware that in this I have opposed to me the weight of our best botanical authorities, from whom I would not yet dare to positively differ until I shall have the weight of more facts. I would only say that in the case of *Liriodendron* the appearances are much in favor of the belief that in an early stage the petiole clasped the stem, and for a considerable length ultimately became an integral part of its cortical system. The vessels which are seen connected in direct lines with the petioles below and above the node, as they are in existence before the leaf bud has opened, and the leaf blade has had any chance to elaborate sap from the light or air, supposed to be necessary just above before they could be formed,

nation became stipular sheaths after having been partially organized as leaf blade; and that *Liriodendron* differs from *Magnolia* only in possessing a greater power of adnation.

### Notes on *SILPHIUM LACINIATUM*, L.—The Compass Plant.

BY THOMAS MEEHAN.

It is at once the strength and the weakness of science that it takes little on trust. One would suppose that, after the positive facts given by President Hill in his paper before the recent meeting of the American Association, there was no room for doubt that the edges of the leaves of *Silphium laciniatum* had an average bearing north. But I find men—excellent, acute observers—who doubt the facts. They say "We took the trouble to examine the plants on the spot, and found not the slightest trace of any such tendency; we want no better evidence than that of our own senses."

As before suggested, it is an excellent habit to verify, for ourselves, the facts reported by others—there is far too little of this habit,—but when the observations conflict, it is safer to assume that both are right, and that there is something yet undiscovered which would harmonize the opposition, than that either one is wrong.

In this matter of the *Silphium* or "compass plant" I was able to find this missing link, and to see that both parties were right.

When I first saw the *Silphium*, to any great extent, in its natural localities, there was not the slightest indication of this northern tendency. It was a great surprise, as a limited knowledge of it before had taught the reverse. I determined to watch a plant carefully on my own grounds the next year. The result was just as described by President Hill. There was the unmistakable northern tendency in the leaves when they first came up, and until they were large and heavy, when winds and rains bore them in different directions, and they evidently had not the power of regaining the points lost. This often took place by their own weight alone, especially in luxuriant specimens. Mr. Hill says it was in June when he saw them on the prairies, all bearing north; when I saw them, and not doing so, it was early in September, and then no doubt the mechanical causes I have referred to, had been in operation.

The plant I have had in my garden now for some years affords much interest in many respects. I learned an useful lesson from it this year, in reference to the relative rates of growth in the different parts of the inflorescence. Noticing that there appeared to be no growth in the disk florets in the day, I determined to note accurately one morning during the last week in August, exactly when growth did commence. The ray flowers close over the disk during night, and at 4 A. M., with day just dawning in the east, I found the ray petals just commencing to open back. In the disk there are about fifteen coils of florets in the spiral. There appeared no motion until 4.40, although no doubt growth commenced at 4, when the ray petals were in motion, but too slow to be perceptible. At 4.40, however, the five outer circles were evidently slightly elevated above the others in the disk. Then follows the following record in my diary:

4.45. The five divisions of the corolla split open.

4.50. Corollas grown three thirty-seconds of an inch.

4.55. Divisions of corolla fully expanded.

5. Florets two-eighths above the rest of the disk. It might be well to say here that there was no growth in any this morning but in the five outside rows we are speaking of.

5.5, 5.10. No apparent change except that some which were not so perfectly opened as the others seemed to become so.

5.15. Pistil and mass of stamens slightly elevate above the level of the corolla.

1870.]

5.20. Corollas now about five-sixteenths of an inch above the others in disk. Pistils and stamens about two lines above the corollas. Long yellow ray petals half open, with no appearance of pollen on their pistils.

From this time forward there was no further growth of the corolla, so that this portion of the daily labor was accomplished in about three quarters of an hour.

5.25. Pistils and stamens beyond the corolla . . . 1-32d inch.

5.30. " " " " . . . 1-16th "

5.35. " " " " . . . 1/4th "

5.40. " " " " . . . 1/4th "

5.45, 5.50. No change.

5.55. Pistils begin to project beyond the stamens. The first insect, a sand wasp appears. He inserts his proboscis down between the clavate pistil and the stamens, carrying away the pollen, which is all over his head.

6, 6.5. Pistils one line; stamens no longer lengthen.

6.10. Anthers are falling away from the pistils, which are two lines beyond.

6.15. No change.

6.20. The ray petals now fully open, that is horizontal.

No change was noticed after this, except the free visits of sand wasps; none of these, however, carried any pollen to the pistils in the ray florets.

About 9 o'clock (there had not been the slightest indications of any growth since 6.20) heavier insects began to arrive, and then the slightest touch broke off the florets, which fell on the ray pistils which happened to be below them, and in this way they were fertilized. These pistils died very soon afterwards. Those pistils on the upper side (the flower leaning a little) were quite fresh the next morning, awaiting some chance to be fertilized, insects, evidently, not performing that office.

We here see that there were three phases of growth, with a slight rest between each, the pistil taking the most time, then the stamens, and the corolla the least; but the whole growth of the day included within two hours.

I have used the term pistil for the clavate process which occupies the place of the true organ in the ray florets. Of course only the ray floret of *Silphium* have perfect pistils. This clavate false pistil, or ovary, has hitherto been supposed to be a necessary production for the fertilization of the plant. It was supposed to push out the pollen, which was thereby scattered to the ray florets about it. But these observations show that this is probably an error, and that fertilization is chiefly carried on by the easy falling away of the mass of stamens, as I have shown in a paper on *Euphorbia Jacquinæflora*, in last year's *Proceedings* & the case will that spring 189

## ACANTHOPTERYGII.

**APOGON AMERICANUS** *Apogonichthys* Castelnau, Voyage Amer. Merid. Tab. I.  
Cope, Trans. Amer. Philos. Soc. 1866, 400.

**PRACANTHUS ALTUS** Gill, Proc. Acad. Nat. Sci., Phila., 1862, 132.

**HYPORTHODUS FLAVICAUDA** Gill, l. c. 1861, 98 ; 1862, 133.

**PRONICROPTERUS DECORATUS** Gill, Proc. A. N. Sci., 1863, 164.

D. II. 26. A. 16 scales 11—98—46, counted from base of second dorsal spine. Dorsal fins connected by membrane as elevated as that of the first dorsal. Head (from premaxilla to end of spine) more than four times in length including caudal fin. Pectorals not narrowed. Eye 5.33 times in length of head. Otherwise as in *P. maculatus* Hol.

Color dark brown, covered with large round pale spots as large as the orbit, each with a brown central spot. They extend on the dorsal and proximal caudal fins. Second dorsal, anal, and caudal fin broadly blackish edged.

Another character in which this species differs from *P. maculatus* is the gentle and gradual rise of the lateral line from the suprascapula. In the latter, it forms a weak sigmoid with abrupt upward curvature. From Newport, Rhode Island ; discovered by my friend Samuel Powell of that place, among many other highly interesting fishes. As no one else has detected the *Pronicropterus decoratus* on any other part of the coast of the United States, it must be a rare species. Prof. Gill originally described it as coming from Panama.

**VOMER CURTUS** Cope, sp. nov.

This species is intermediate in form between *Vomer setipinnis* Mitch., and *Sclene argentea* Lac. It is, therefore, shorter and deeper than the former, and with dorsal and ventral outline more convex. The pectoral fin is also longer, and the eye larger. The prominence of the front is anterior in position to that which it occupies in the latter, hence the fish has a less rhomboid, and more regular form. The first anal ray is further in advance of the first of the second dorsal than in *V. brownii*, and not so far as in *S. argentea*.

Radii D. III with membrane, III without,—22. A 19. The pectoral reaches the ventral outline at the tenth soft anal ray. The greatest depth of the head measured along the anterior limb of the orbit enters the total to the caudal emargination 1.8 times—in *V. setipinnis* 2.5 times ; depth at first anal ray, in the same, 1.66 times ; in *V. setipinnis* nearly twice. Eye into length of head, horizontally through orbit, 2.75 times ; into length along front, 4.6 times. Muzzle projecting enclosing a strong concavity with front line much stronger than in *V. brownii* or *S. argentea*. Total length 0m. 165. Length of head from muzzle along lower margin of orbit 0m. 046. Color silvery, without spots.

A second specimen from the North American Atlantic coast, the precise locality not recorded. Bonaparte collection in Mus. Academy Natural Sciences.

The structure of the fins in this species is precisely similar to that seen in *V. setipinnis*, and in general it resembles that species very closely. The differences are readily observed on comparison with specimens of the latter of the same size.

**SAROTRHODUS MACULOCINCTUS** Gill, Pr. A. N. Sci., 1861, 99. Only found at Newport.

**GLYPHODON SAXATILIS** Linn.

An abundant West Indian species.

## MALACOPTERYGII.

**HEMIRHAMPHUS UNIFASCIATUS** Ranzani.

A West Indian fish.

1870.]

## PLECTOGNATHI.

*BALISTES POWELLI* Cope, sp. nov.

This is a species allied in form and color to the *B. novilunata*, but apparently nearer to the species of Baillarg's group II. A.\*

Radii 3 D. 16. A. 12. premaxils 3 or 4 on each side: P. 13—4. C. 12 rounded. Form elevated, pelvic depth 1.75 times in total length. Front convex from basis of dorsal fin to spines of premaxillaries. Orbit 3.65 times in muzzle; jaws equal. Scales without prominent spines, those of the cheek in oblique series. Two or three scapular plates. First dorsal spine 1.25 times in length of muzzle, rugose. Third dorsal spine well developed. Anterior rays of second dorsal and anal not much longer than the median rays. Length of head to opercular slit 3.5 times in total: anal depth 2.25 in the same.

Color above, ash, below white. Numerous longitudinally oval azure spots extend in series on the sides everywhere except between the chin, pectoral fin and pelvic bone. The dorsal and anal fins are marked with smaller spots of the same.

This species was discovered by my friend Samuel Powell, at Newport, Rhode Island, Sept. 1867. It must be a very rare species, as it has not been met with elsewhere, so far as I am aware. I have pleasure in dedicating it to the discoverer, whose attention to ichthyology has been so often attended with interesting results.

*TETRAODON TRICHOCEPHALUS* Cope, sp. nov.

Belly spinous to near vent: dorsal region from a little behind the nares to above the ends of the pectoral fins spinous, those on the head long, close set, like seal bristles. Profile suddenly descending from the prefrontal region to the premaxillary region, arched from the former point backwards. Eye 3.5 times in head, 2.65 times in muzzle: length of head 3.5 times in total including caudal fin. Radii, D. 8. A. 7. Caudal fin even with prominent points, concave when closed. Anal fin behind opposite the dorsal. Frontal width 1.25 times in orbit. Length four inches.

Color, below to a line from the chin to the inferior third of the caudal fin, white; above yellowish passing into brown on the dorsal region. The latter color is faintly vermiculated with the paler color, as it descends on the sides. Fins uniform straw colored: a brown spot at the base of the pectoral fin.

This species differs in color from *T. turgidus* Mitch., and in the less extent and longer form of the spines, as well as in the declive front. The young of *T. turgidus* of one-fifth the length have a more slender muzzle and other char-

short. Maxillary smooth; cheeks and operculum scaly, the cheek minutely. Scales ceasing on vertex at a point behind a vertical drawn from the posterior margin of the pupil. Interorbital width  $\cdot 70$  of the diameter of the orbit. Latter a little less than length of muzzle, four times in length of head to base of longest spine. Depth at ventral fins  $2\cdot 75$  times in length without caudal fin. Length of head (without opercular flap)  $2\cdot 66$  times in same.

The coloration is handsome. Ground chocolate brown, the cheeks interoperculum, mandible and maxillary region with a coarse net-work of white lines. Pectoral region paler, and fading on the belly to a white and then metallic citron yellow, which is bounded abruptly by the ground color behind, at a point a little in advance of the anal fin. The posterior outline rises irregularly half way to the lateral line and then turns forward and descends a short distance behind the pectoral fin. From this patch backwards to the basis of the caudal fin there are five vertical cross-bands, two on the peduncle and two rising from the anal fin. The latter diverge above and another band rises, expanding to the point of junction of the dorsal fins, and spreads in a rounded black spot to their margin. The pectoral and caudal fins are white, with rows of small brown spots, the second dorsal and anal brown with rows of small white spots.

Length  $0m\ 075$ ; to basis DI.  $\cdot 026$ , to basis of anal  $\cdot 044$ ; longest dorsal spine  $\cdot 010$ ; depth caudal peduncle  $\cdot 0095$ ; length do. above  $\cdot 0055$ .

The habitat of this sea perch is the southern coast near Pensacola. It was contained in a bottle with *Abastor erythrogrammus*, *Elaps fulvius*, etc. Its zoological affinities are to the *C. phoebe* of Poey, and other West Indian species; it is one of the most elegant of the genus.

**GOBIESOX STRUMOSUS** Cope, sp. nov.

Radii, D. XI; C. 16; A. 10; P. 21. Head exceedingly wide, width  $2\ 5$ - $6$ ths times in total including caudal fin. This width is partly produced by a large fleshy mass which extends from the end of the prominent extremity of the maxillary bone to the end of the interoperculum. Subopercular spine short, stout. Eyes small, diameter  $2\cdot 5$  times in interorbital width, over seven times in head, more than twice in muzzle. Superior dental series twelve on each side externally, but the three median conceal some series of which the second three external are a continuation. Inferior teeth eleven on each side; four median incisors, horizontal and subequal; no marked canine. Vertex flat, profile descending abruptly from posterior line of the orbits to labial margin. Anterior basis of dorsal in front of last fourth of length exclusive of caudal fin.

Length two and a half inches. Color in spirits bluish lead-color; fins blackish.

From Hilton Head, S. Carolina. Presented to the Academy of Natural Sciences by Thos. J. Craven.

*Note on Fishes from Atlantic City, N. J.*

A small and interesting collection of fishes, made at the above locality, was placed in my hands for determination by Edward S. Keed. He has added two species to the marine fauna of New Jersey, which I here note:

**PRIACANTHUS ALTUS** Gill, supra.

**HEMIRHAMPHUS MACRORHYNCHUS** C. V. Putnam, Proceed. Bost. Soc. N. H., 1870, p. 236.

This West Indian species was not known from the Eastern coast of the United States prior to the notice of Prof. Putnam, above cited, who procured it from the coast of Massachusetts.

1870.]

November 1st.

WM. S. VAUX, Vice-President, in the Chair.

Twenty-nine members present.

PROF. LEIDY exhibited the tooth of a reptile which had been submitted to his examination from the Smithsonian Institution. The specimen, he observed, was especially interesting, as it apparently pertained to a mosasauroid, and was obtained from the miocene tertiary deposit of Gay Head, Martha's Vineyard.

The crown of the tooth is curved conical, and is without divisional planes. The inner surface is only feebly defined from the outer, by a single imperfectly developed ridge postero-internally.

The enamel is singularly roughened, due to short vermicular, somewhat ramifying and more or less interrupted ridges, giving it a fretted or lettered appearance. The transverse section of the crown is circular.

The fang of the tooth, broken below and on the inner side so as to expose the interior pulp cavity, is longer than the crown and very gibbous. It is curved in the direction of the crown and is ovoidal in shape. The texture of the fang appears as dense as ivory. No impress exists on the exterior of the fang, resulting from contact with a successional tooth, but a deep groove occupies its inner side at the terminal extremity.

The crown is broken at its apex, but when perfect has been about 16 lines long, measured on the outer side. The diameter at base is a little over half the length. The fang has been about two inches long; its diameter is 17 lines.

The tooth evidently indicates an animal heretofore unknown to us, and I therefore propose for it the name of *GRAPHIODON VINEARIUS*; the generic term having allusion to the lettered appearance of the enamel of the tooth.

PROF. LEIDY further remarked that he had recently received from Prof. Hayden's expedition a collection of fossils, mostly consisting of remains of turtles and crocodiles. He formerly had expressed surprise at the absence of remains of the latter among the great profusion of remains of mammals and turtles in the Mauvaises Terres deposits of White River and the sands of the valley of the Niobrara River. He now felt some wonder at seeing so many crocodilian remains, apparently of cotemporaneous age with some of the latter. The reptilian remains are generally in a very fragmentary condition, and have been picked up from the surface of the country. Several unde-

November 8th.

The President, DR. RUSCHENBERGER, in the Chair.

Twenty-two members present.

A paper was presented for publication entitled, "Bud Varieties," by Thomas Meehan.

PROF. LEIDY directed attention to some remains of reptiles on the table, which were part of the collection of fossils recently sent to him from Wyoming by Prof. Hayden. They consist of the remains of three species of turtles and a lacertian, which were briefly characterized and named as follows:

**EMYS JEANESI.**—The species is founded upon a shell consisting of the nearly complete carapace and sternum, the former much crushed and distorted laterally. The carapace has been prominently convex, with the margins acute and without conspicuous indentations. The sternum is as well developed as in our common living emydes and of the same shape. The fore part of the sternum forms a semicircle slightly truncate; the back part is moderately notched, the notch being about half an inch in depth.

The intermediate vertebral scutes are longer than broad, and their anterior margin is transversely bow-like, with a deep median angle forward. The sides of the second vertebral scute, joining the first pair of costal scutes, are convex outwardly; joining the second of the latter, are convex inwardly.

The axillary and inguinal scutes are broader than long. The abdominal and femoral scutes are of nearly equal depth, about  $2\frac{1}{2}$  inches; the humeral are half an inch less; and the pectoral and caudal an inch less.

The sternum is a foot in length; its anterior portion is  $3\frac{1}{4}$  inches deep and 5 inches wide; its posterior portion  $3\frac{3}{4}$  inches deep and  $5\frac{1}{4}$  inches wide.

The length of the carapace in the curve has been about fifteen inches; the width about nine and a half inches.

The species I have dedicated to my friend Joseph Jeanes, through whose aid we have been enabled to make many additions to the store of palæontological knowledge.

**EMYS HAYDENI.**—This species is founded upon an imperfect carapace of an animal probably about the size of the last, but which had not yet reached maturity. It may be distinguished from it by the form of the scute impressions. The intermediate vertebral scutes are longer than broad, as in the former. The anterior border of the second vertebral scute is straight, as are also the sides of junction with the first pair of costal scutes, the three lines together forming three sides of a square. The anterior border of the third vertebral scute is nearly straight; and that of the fourth is deeply bow-like and convex backward.

Notwithstanding I have already dedicated several extinct species of animals to my friend Prof. Hayden, I still add another to the list in commemoration of the very many discoveries he has made in vertebrate palæontology.

**BAENA ARENOSA.**—The genus and species are founded on the greater part of the shell of a turtle, with the carapace broken away in front and fractured in other positions. The sternum, more perfect, has lost its fore extremity. The shell belonged to a mature animal, as indicated by the obliteration of the sutures of the plates composing the carapace. The surface of the latter, but more especially that of the sternum, presents a finely fretted appearance.

The carapace is moderately convex and bears a resemblance to that of our common Snapper (*Chelydra serpentina*). It is, however, not depressed along the middle, which is the most elevated portion of the fossil. The lateral marginal plates are comparatively large and broad, and are abruptly bent. The posterior portion of the carapace, both laterally and at the extremity, is

1870.]

notched much in the same manner as in the Snapper. The intermediate vertebral scute impressions have nearly the form and proportions as in the latter, but are not carinated in the median line, and the posterior line of the fourth vertebral scute impression is deeply and widely notched forward.

The sternum is very unlike that of the Snapper, and rather approaches that of the emydes in its form and proportions. The interspaces of the carapace and sternum are, however, intermediate in capacity to those in the former and latter. The sternal pedicels are deep and wide, and are impressed by a pair of large scutes, separating the large axillary and inguinal scute, as in the existing *Dermatemys*. The posterior extremity of the sternum in outline is half oval and feebly notched.

When complete the shell has measured between a foot and fourteen inches in length and about ten inches in breadth. The sternum has been about ten and a half inches long; its pedicels are  $5\frac{1}{2}$  inches deep; and its posterior extremity is 3 inches long by  $4\frac{1}{2}$  inches wide at base.

For the genus I have adopted a name which, according to Prof. Hayden, is used by one of the Indian tribes of the Upper Missouri as that of a turtle. The species I propose to name *BÆNA ARENOSA*.

*SAXIWA ENSIDENS*.—Among the fossils obtained in Prof. Hayden's expedition are the remains of a lacertian, labeled as having been discovered near "Grauger." The bones consist of those of most parts of the skeleton, but are all in a fragmentary condition, and are imbedded in freshly broken pieces of an ash-colored rock. Before disturbance they appear to have been mostly entire and preserved nearly in conjunction. They are black, and their interior is occupied with crystalline calcite.

Fragments of bones exhibit well developed limbs, with long toes, strong ribs, and a long tail, altogether indicating a form like that of ordinary living lacertians. The long bones, even to those of the toes, are hollow. The vertebræ exhibit the ball and socket articulation of their bodies, but only a single pair of zygapophyses in front and behind. No zygantral and zygosphenal articulation appears to have existed.

The articular ball of the vertebral body is much wider than high, and is directed upward, with an inclination backward.

The body of several dorsals is quite straight inferiorly, fore and aft, and measures half an inch in length. The ball is four lines wide, and about half as thick. The breadth at the anterior zygapophyses is eight lines, and at the articulations for the ribs, just exterior to the latter, three-fourths of an inch.

An anterior caudal has its body the same length as in the preceding. Its ball is  $3\frac{1}{4}$  lines by  $2\frac{1}{4}$  thick. The width at the anterior zygapophyses is half

MR. THOMAS MEEHAN referred to a potato presented to the Academy some months ago by Mr. Henszey, a member, which had the appearance of one potato growing out of the centre of another. The opinion of all who saw it was that it was really a case of this kind. It had been handed to him by the curators, and on dissection, though no exact place of origin could be traced, there seemed nothing to indicate any other theory of origin than that one potato had really grown out of the centre of the other.

But there were serious physiological reasons in the way of such a theory. A potato tuber is really but a thickened axis, in which the greater part of the interior structure would be incapable of developing a bud which would produce a tuber such as this one had done. The origin of a new tuber from an old one would be nearer the old ones surface. He had been looking for some further explanatory facts, and believed he had them here this evening, in the potato tubers he now handed to the members. They were about the size of hen eggs, and were pierced in every direction by stolons of the common couch grass, *Triticum repens*. They had gone completely through, as if they were so much wire, and in one instance two tubers had become strung together by the same stolon, as if they were two beads on a string. One would suppose that the apex of the stolon, when it came in contact with the hard surface of the tuber, would turn aside and rather follow the softer line of the earth; but there was no appearance of any inclination to depart from their direct course. They had gone apparently straight through. He had no doubt the potato before referred to was a similar case, a potato stolon had penetrated another potato, and instead of going through as these grass spears had done, terminated in the centre, and formed the new potato there.

It was worthy of thought whether so much attention had been given to this direct force in plants as the subject deserved. It was well known that a mushroom would lift a paving stone many times its own weight, rather than turn over and grow sideways, which it would appear so much easier for it to do; and tree roots growing against walls would throw immensely strong ones over, though one would think the pressure against the softer soil would give room for their development, without the necessity of their expending so much force against the wall.

---

November 15th.

The President, DR. RUSCHENBERGER, in the Chair.

Twenty-seven members present.

A paper was presented for publication entitled "A Sketch of the Classification of the American Anserinæ," by B. H. Bannister.

PROF. LEIDY directed attention to some fossil bones which had been submitted to his examination by Prof. J. D. Whitney. According to the accompanying label, they were found under Table Mountain, near Shaw Flat, Tuolumne Co., California.

The bones are friable, and have attached portions of a light ash colored gravel. Several masses of the latter substance, accompanying the bones, contain casts of some fruit.

The bones are as follow :

1. A metacarpal bone of a ruminant of large size. In form and construction it bears more resemblance to that of the Lama and Camel, than of other ruminants with which I have the means of comparing it. As in the Lama and Camel the lower articular extremities are divergent, and the articular surfaces are provided with a median ridge only at the back part. In ordinary ruminants, as in the Ox, Deer, Sheep, etc., the median ridge is produced the entire extent fore and aft of the articular surfaces. The peculiar arrangement

THE JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION

PUBLISHED WEEKLY  
535 N. Dearborn Ave., Chicago, Ill.  
Subscription price, \$5.00 per annum in advance.  
Single copies, 15 cents.

Published for the American Medical Association

By the JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, INC.

Copyright, 1934, by the American Medical Association  
All rights reserved. No part of this publication may be reproduced without permission in writing from the American Medical Association.

Published by the American Medical Association, 535 N. Dearborn Ave., Chicago, Ill. 60610.  
Second-class postage paid at Chicago, Ill., and at additional mailing offices.  
Postmaster: Please send address changes in the enclosed card to the JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 535 N. Dearborn Ave., Chicago, Ill. 60610.

Entered as Second-Class Matter, May 2, 1912, Post Office at Chicago, Ill., under No. 100,000.  
Acceptance for mailing at special rate of postage provided for in Act of October 3, 1917, authorized on July 1, 1934.

Postage paid at Chicago, Ill., and at additional mailing offices.  
Postmaster: Please send address changes in the enclosed card to the JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 535 N. Dearborn Ave., Chicago, Ill. 60610.

Published by the American Medical Association, 535 N. Dearborn Ave., Chicago, Ill. 60610.  
Second-class postage paid at Chicago, Ill., and at additional mailing offices.

Postmaster: Please send address changes in the enclosed card to the JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 535 N. Dearborn Ave., Chicago, Ill. 60610.

Published by the American Medical Association, 535 N. Dearborn Ave., Chicago, Ill. 60610.

For a complete list of advertising rates and conditions, apply to the JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, 535 N. Dearborn Ave., Chicago, Ill. 60610.

horses, which, in the absence of original specimens, afforded him the opportunity of making comparisons with the many equine teeth discovered in the tertiary and quaternary deposits of North America.

Prof. Owen describes a new species of *Equus* from South America, which he names *E. arcidens*. From peculiarities of the teeth, he refers this species, together with two others, also from South America, and named by Dr. Lund *E. principalis* and *E. neogaeus*, to a genus with the name of *Hippidion*. From some of the more important distinctive characters, viz., the extension backward alone of the internal peninsular folds on the triturating surface of the upper molars, a dozen years ago was established the genus *Protohippus* (Pr. A. N. S. 1858, 26, with reference to fig. 1, pl. 7 of Gervais' Rech. s. l. Mammifères Fossiles de l'Amérique meridionale). On the same grounds were also included in this genus the *E. principalis* and *E. neogaeus* of Lund, together with *E. macrognathus* of Gervais, so far as the remains of the latter appeared to me to be the equivalent of *E. principalis*, (Extinct Mammalia of Dakota and Nebraska, &c., 1869, 276). \*

The species of equine animals referable to the genus thus far indicated are as follow :

PROTOHIPPIUS, Leidy, 1858.

*Hippidion*, Owen, 1869.

1. PROTOHIPPIUS PERDITUS.

*Equus (Protohippus) perditus*, Leidy: Pr. A. N. S. 1858, 26; Ext. Mam. Fauna of Dakota, &c. 1869, 275, 327, 401.

2. PROTOHIPPIUS ARCIDENS.

*Equus arcidens*, Owen: Phil. Tr. Roy. Soc. London, 1870, 559.

*Equus (Hippidion) arcidens*, Owen: Ibidem, 572.

3. PROTOHIPPIUS PRINCIPALIS.

*Equus principalis*, Lund: K. Danske Vidensk. Selskab. 93, pl. xlix, fig. 1.

*Equus neogaeus*, Gervais: Rech. Mammif. Fos. de l'Amer. Merid. 1855, 33, pl. vii, fig. 1.

*Equus macrognathus*, Gervais: Ibidem, pl. vii, fig. 1.

*Equus (Hippidion) principalis*, Owen: Phil. Tr. 572, 573.

4. PROTOHIPPIUS NEOGAEUS.

*Equus neogaeus*, Lund: K. Danske Vid. Sels. 93, xlix, fig. 3.

*Equus (Hippidion) neogaeus*, Owen: Phil. Tr. 572, 573.

5. PROTOHIPPIUS PLACIDUS.

Leidy: Ext. Mam. Fauna of Dakota, &c. 277, 328, 401.

6. PROTOHIPPIUS SUPREMIUS.

Leidy: Ext. Mam. Fauna of Dakota, &c. 328, 401.

In the same Transactions appears a paper, by Prof. W. Thomson, "on *Holmia*, a genus of vitreous sponges," accompanied with beautiful illustrations. The genus, however, appears to me to be synonymous with *Pheronema* (Pr. A. N. S. 1868, Biolog. and Micros. Dep. 9). A comparison of the figures of *Holmia Carpenteri*, with those of *Pheronema Annæ* (Am. Naturalist, 1870, 21, 22), leads me to suspect that the two are probably the same.

November 22d.

MR. J. D. SERGEANT in the Chair.

Six members present.

\* In page 271 of the Ext. Mam. Fauna of Dakota and Nebraska, figs. 2, 3, have been erroneously quoted instead of fig. 1 of Gervais, pl. vii, of the Rech. sur les Mammif. Fos. de l'Amer. Merid.

November 29th.

The President, DR. RUSCHENBERGER, in the Chair.

Thirty-three members present.

The report of the Microscopical and Biological Section for September, October and November was read, and referred to the Publication Committee.

The publication of pages 102 to 124 inclusive, of the Proceedings for 1870 was announced.

The following gentlemen were elected members:

E. Wildman, M. D., David L. Collier, William H. Dougherty, W. H. Wahl, M. D., Chas. Schaffner, M. D., J. Ewing Mears, M. D.

On favorable report of the Committees the following papers were ordered to be printed.

#### BUD VARIETIES.

BY THOMAS MEEHAN.

A few years ago, Mr. Isaac Burk, of the Academy, called my attention to a form of *Rubus villosus*, L., in which the terminal leaflet was very large, cordate, and on very long petioles. It is a very striking variety, the leaflets appearing at first glance like large linden leaves. He found them in Delaware County. I have since gathered the same form near the intersection in Chester County, near Port Clinton on the Reading Railroad, and along the west bank of the Susquehanna, between Harrisburg and the mouth of the Juniata.

The general forms of *Rubus villosus* are found uniformly in all parts of the State, and, of course, without any break in their appearance between the localities named above. The plant so easily maintains its existence by pieces of roots, and grows as well in sunshine as in shade, in dry and poor as well as in rich and damp places, that it is not easily eradicated when once it obtains possession of the soil. On the idea that varieties originated from one common centre, it is not easy to account for the existence of the same forms so many miles apart, as we find in the above, except by the accidental carrying of seeds.

But I have reason to believe that seeds of *Rubus* rarely germinate in a wild state.

description has been published, as *R. neglectus*, Peck. This form is found in isolated places in New York, Northern Pennsylvania, Ohio, and Iowa, and perhaps elsewhere. As in the case of the form of *R. villosus* referred to, there does not seem to be any connection between the localities, as a common centre spreading by roots would imply, while there is the same difficulties in the way of spreading by seeds as in the other. How, then, does this form originate in these widely separated places.

Horticulture may help us to answer this question. It is well known that fruits, after being grown for some time in one locality, will change their characters to such an extent that a person acquainted with one will fail to recognize it elsewhere, and all this without the intervention of any seminal power. Thus, the nectarine is believed to be a bud evolution from a peach; the Penn apple is a similar creation from Baldwin, and the Reading from the common labella grape. Though apparently originating in this way from external or local causes, the characters peculiar in this change are retained when, by grafts or cuttings, the plants are removed to other localities. It has also been noted that the pears grown at Rochester, New York, have longer stems than the same varieties grown further south; but I do not know whether this peculiarity, once originated, would follow the grafts or cuttings taken from them. The curled-leaved willow, *Salix babylonica annularis*, was a branch from the common weeping willow, which character it usually retains, though sometimes a branch, resembling the common weeping, will push out from the tree. Of like character is the well-known instance of purple-flowered laburnums sometimes pushing out from the common yellow-flowered one. But perhaps the best known instances are those of the common potato. It is not at all unfrequent to find some of quite another character and color in the same hill. Those who contend for seed agency as the sole originator of varieties will rather believe that there was some other variety of potato accidentally planted with the other than that a new variety sprung from the bud alone. But the evidence of origin from the same original potato-set has, in many instances, been too direct to be doubted; but, even here, rather than admit the doctrine of development through buds, I have heard it *assumed*, by intelligent botanists, that the flowers in such cases *must have been* impregnated with other pollen, and, in *some way*, the descending sap brought about a sort of hybridism or bud change in these tubers. I have also heard excellent and leading botanists (two of them authors of some of our leading works) suggest that many of the varieties of *Rubus* in existence *must be* "hybrids." Of course, this is all assumption, founded on extensive observation, no doubt; but yet on probably no better foundation than my own idea with which I set out in this paper—that often, at least in the cases I have referred to, hybridization is highly improbable.

I have here, however, and exhibit with this paper, evidence of bud variation, in which there is no possibility of hybridism. A root of the common sweet potato, *Convolvulus batatas*, in which some of the tubers are of the red Bermuda, and the others of the white Brazilian variety.

The sweet potato never flowers in this part of the country, so that seminal power could have had no influence whatever on the phenomenon. Even in the south, and I believe elsewhere, where this plant is cultivated for its roots, it rarely flowers, and I think there is little doubt but that the whole ten or twelve varieties under culture have originated without seed, and in the way we see them here.

The points I wish to make in this paper are:—

1st. That identical varieties sometimes appear in localities unfavorable to the idea of a common centre of origin.

2d. Varieties have originated in which *probably* no hybridism or any seminal agency operated.

3d. Varieties have *certainly* originated in the sweet potato by evolution,  
1870.]

without seminal agency, and that the same variety in this way has appeared in widely-separated districts.

4th. As the discoveries of Darwin have shown in many cases, varieties to be the parents of species, species may originate in widely-separated localities by bud variation.

#### A Sketch of the Classification of the American ANSERINÆ.

BY B. H. BANNISTER.

The following remarks are based upon an examination of the specimens of American geese in the collection of the Smithsonian Institution.

The subfamily Anserinæ by many recent authors is made to include the genera *Dendrocygna* and *Chenalopez*, and doubtless correctly. In the present paper, however, we shall not consider these genera, leaving them provisionally out of the subfamily, if included, they would form at least one well marked section, following those we are about to describe.

The distinguishing characters of the Anserinæ, as thus limited to the true geese, are, the lengthened tarsus, covered with hexagonal or subquadrate scales; the neck more elongated than in the ducks and less so than in the swans; the short, high bill gradually narrowing toward the tip, which is altogether composed of the large recurved nail; together with the more or less terrestrial habit of life, and the usually similar plumage of the two sexes.

The geese of the North American continent have been long known, and being for the most part closely allied to, and in many cases identical with, well known European forms, they fall readily into the systematic subdivisions based upon the latter. In the temperate regions of South America, however, the Anserinæ are of a rather aberrant type, and have been less completely studied. They differ chiefly from the North American and European species in possessing metallic tints on the plumage, and in having in two of the genera the coloration of the two sexes widely different. These differences appear to be exclusively regional, none of the aberrant forms being found in North America, and *vice versa*.

Another basis of division of the American Anserinæ is found in the presence, in two species—one North American and the other a Southern form—of deep rough superorbital depressions and reversed relative proportions of the tarsus and middle toe, together with an exclusively sea-coast habitat, and a *vice versa* but corresponding in some of these respects to the *Oleminæ*.

appearing prominently below the edge of the upper mandible. Bill and feet light colored; colors of plumage generally sober, the shades of brown and gray predominating.

- Species *Anser hyperboreus*, Pall. N. America and West Indies.  
 " *rossii*, Baird. Central regions H. B. Terr.; Cala.  
 " *cærulescens*, L. Central U. S.; Hudson's Bay.  
 " *ferus*. ? Pr. William's Land.  
 " *segetum*, Gm. ? Hudson's Bay.  
 " *gambelli*, Hartl. N. America.

## 2. BRANTA SCOPOLI.\*

*Gen. Char.* Bill short, lamellæ not projecting below upper mandible. Bill and feet black; neck always black.

- Species *Branta canadensis*, L. N. America.  
 " *hutchinsii*, Rich. & Sw. N. America.  
 " *bernicla*, L. Eastern and central N. America.  
 " *nigricans*, Lawr. West coast of N. America.  
 " *leucopsis*, Bechst. N. E. of N. America. Rare.

*b. Aberrant.* Plumage with metallic reflections on speculum; colors of sexes not invariably similar. Membrane of toes somewhat scolloped out in front.

## 3. ORESSOCHEN, n. g.

*Gen. Char.* Bill very robust, light colored, lamellæ not projecting. Feet robust, light colored, hallux well developed. Plumage of sexes similar; colors simple.

- Species *Oressochen melanopterus*, Gay. Highland regions of Chili.

## 4. CHLÆTROPHUS, n. g.

*Gen. Char.* Bill moderate, black. Feet particolored, black and orange. Colors of sexes similar. Plumage rather brilliant for this subfamily.

- Species *Chlætrophus poliocephalus*, Gray. Coasts of Patagonia and adjacent islands.  
 " *rubidiceps*, Sclater. Falkland Islands.

## 5. CHLÆPHAGA, Eyton.

*Gen. Char.* Bill as in the last genus. Feet varying in color with the sex—black in the male, yellow in the female. Plumage of the two sexes quite different, and generally less bright colored than in *Chlætrophus*.

- Species *Chlæphaga magellanica*, Gm. Chili and Patagonia.  
 " *picta*, Gm. " "

Section B. *Philactæ*. Skull with well marked rough superorbital depressions. Tarsus as short as or shorter than the middle toe with its claw. Habits littoral.

## 6. PHILACTE, n. g.

Bill short, moderately robust, light colored, nail of both upper and lower mandibles quite prominent, lamellæ appearing as pointed processes in the posterior part of the commissure. Feet moderate, light colored. General tint of plumage light, no metallic reflections.

- Species *Philacte canagica*, Lewast. N. W. coast of N. America; ? Caspian.

\* The genus *Branta* was adopted from Klein by Scopoli in 1769, the first species being *Anas bernicla*, L. This, according to usage, will have to be substituted for *Bernicla* of Boie (1822), and also antedates his genus *Branta*, established at the same time, the type of which is *Anas rufina*, Pall.

## 7. TENIDESTES, Reich.

*Gen. Char.* Bill robust, varying in color with the sex, as also does the plumage; lower mandible deep, nail prominent, lamellæ not projecting. Feet robust, varying in color with the sex, tarsus shorter than middle toe with claw. Colors of female with metallic reflections on the speculum.

Species *Tenidestes antarcticus*, Gm. Southern extremity of S. America, and adjacent islands; Chili.

December 6th.

The President, DR. RUSCHENBERGER, in the Chair.

Thirty-three members present.

Prof. Cope made some observations on a number of species of reptiles from the Cretaceous beds of Kansas, which he had recently studied. He stated that the specimens included parts of *Eosaurus platyrus* Cope, *Polycotylus latipinnus* Cope, *Liodon proriger* Cope, and two new Liodons, which he named *L. ietericus* and *L. mudgei* respectively. They both belonged to the division with depressed vertebral centra, and the *L. ietericus* was near *L. validus* Cope, of New Jersey, but exhibited a less anterior, and less prominent proximal external angle of the quadratum, which Prof. Cope stated indicated a less extensive lateral flexibility of the ramus of the mandible.

In *L. Mudgei* the angle was still more posterior, and the pterygoid teeth were not pleurodont, as in *Platecarpus tympanicus*. Remains of the cranium indicated a reptile of 30 feet in length, while those of the *L. ietericus* belonged to two individuals of 40 and 50 feet in length. A third new Mosasauroid of the size of the *L. Mudgei* was described under the name of *Clidastes anseriorum*. It was stated to be much the largest species of the genus, and to differ from the three now known in having the plane of the articular extremities at right angles to the long axis of the centra, and not oblique to it. From near Sheridan, Kansas; described by Prof. B. F. Mudge. He described a third new Liodon, of gigantic size, stating it to exceed by very much the Maastricht reptile, and even the *Mosaurus brumbzi* Gibbes, which was till now the largest known species. He pointed out the characters of the vertebrae, which were very much depressed as to the centrum, which measured  $5\frac{1}{2}$  inches in diameter. It was allied to the *M. brumbzi*, but differed in having a strong emargination of the articular faces to accommodate the neural canal.

that there were four cotyledons and two germs, and that the place of union was midway between the pairs of cotyledons. From the base of the cotyledons extending the whole length of the radicle, the union existed. The length of this united part was from half an inch to one inch, according to the vigor of the plant.

Another lesson he thought was afforded by these specimens. Dr. Asa Gray had recently remarked, in *Silliman's Journal*, that European botanists still believed what American botanists had learned to doubt, that the radicle was a true root, rather than a morphologized joint of stem. Here was, he believed, an illustration of the American view. These radicles, which had evidently united together under the seed coat, had elongated after protrusion, just as a young shoot with all its parts formed in the bud elongates after the bursting of the bud scales. They comprised the half inch, or inch united portions before referred to. If these radicular portions of the seed were of the nature of root rather than of stem, we might expect to see lateral fibres push from them, as we do see from the true roots, which start out below the union. But these parts are as free from rootlets as any portion of the true stems above the cotyledon points, indicating, as had been suggested, that their properties were rather of stem than of root.

---

December 13th.

The President, DR. RUSCHENBERGER, in the Chair.

Thirty-five members present.

The following paper was presented for publication :

"Remarks on Dr. Asa Gray's Notes on Buckley's Rare Plants of Texas." By Prof. S. B. Buckley.

PROF. LEIDY exhibited a lower jaw of an aged man, recently obtained in his dissecting room. The teeth had all been lost except one, and the alveolar border had been absorbed so that the body of the bone was reduced as usual to half its original depth. The remaining tooth is a completely developed and full grown third molar of large size, which lies imbedded in the jaw horizontally, with the unworn triturating surface directed towards the position which had been occupied by the teeth in advance. The tooth is perfectly sound, and in this old jaw, in which all the other teeth had been lost and the alveoli obliterated, favors the view that the teeth are liable to caries only when exposed to exterior influences. Similar specimens of teeth remaining imbedded in the jaw are not unfrequent, but the one exhibited is the oldest which Prof. Leidy had seen.

PROF. LEIDY also exhibited a wood carving from St. Paul de Loando, Western Africa, presented to him by Dr. Charles L. Cassin, U. S. N. The carving, by a native African, represents two adult human figures, apparently of the two, united by an intervening plate, so as to remind one of the famous Siamese twins. The connection may have been merely intended for support, though Prof. Leidy thought the carving may have been intended to represent a pair of united twins, similar to those just named, and which existed in the locality in which the carving was made.

---

December 20th.

MR. VAUX, Vice-President, in the Chair.

Twenty-two members present.

1870.]

The following paper was presented for publication :

"A new classification of the North American Falconidae, with descriptions of three new species." By Robert Ridgway.

PROF LEIBY directed attention to a preparation of the trunk of an adult male subject, from the dissecting room of the University, in which all the viscera were reversed in the order of their natural position. The heart is reversed in position with its apex directed to the right. The aorta descends on the right side, and the vae are placed on the left of the vertebral column. The liver is placed on the left, the spleen on the right side. The stomach is reversed, and the large intestine commencing in the left iliac region terminates in the rectum from the right side.

THOS. D. RAY called the attention of the Academy to a remarkable exposure of rock on the North Pennsylvania Railroad between Abington and Eagle Hill stations, about eleven miles from Philadelphia. The rock is Pottsville sandstone, highly micaceous, in strata nearly vertical, and divided by frequent joints. Its strike is about N. by E. At the point mentioned a quarry has been opened following the crest of the hill, the northern end of the quarry giving therefore a section. At the bottom of the excavation the layers seem undisturbed and perfectly vertical, but above they are thrown to the S. W. and crushed and broken in a remarkable manner, the layers nearest the surface being horizontal or even dipping to the S. W., but still retaining their relative positions. The breaks in the rocks are fresh and sharp, and the spaces between them empty, and the whole appearance is as if a very recent force acting near the surface had thrown them from a vertical into their present positions. Some of these spaces were two or three inches in width and apparently of great depth.

It is probable, however, that it is due to a folding of the strata, as is seen out of the Railroad immediately west of this exposure. The rocks of the quarry appear perfectly vertical while south of them, probably fifty feet away, defined anticlinal axis or fold. Still the broken, not broken, and the rocks, their very marked and sudden change from the vertical, the freshness and sharpness of the fractures seem almost irreconcilable with a folding taking place as long ago as this anticlinal axis, and it is well worthy of examination by geologists.

*December 27th.*

The President, DR. RUSCHENBERGER, in the Chair.

Thirty-four members present.

On motion, the election of members was postponed until the next meeting for business.

PROF LEIBY called attention to an interesting geological phenomenon in the vicinity of Wayne station on the Germantown Railroad about three miles from Philadelphia. At the point where Wayne street cuts through a fold in the micaceous schists of this district, there occur huge imbedded boulders of very hard compact hornblende rock. The matrix of mica schist has the appearance of an altered argillaceous slate, and rapidly decays on exposure. The hornblende rocks are thus left protruding above the soil, and would be difficult to account for if attention had not previously been called to them in place. As occurring in the schist, they are rounded upon their corners and edges and smooth upon the sides. It does not appear an improbable conjecture to suppose that they constituted a part of a primitive surface formation—perhaps the original earth crust—which was broken up before the de-

[Dec.

position of the metamorphic rocks which make up the azoic rocks of undetermined geological age, overlying the southeastern angle of Pennsylvania. And that by stream and current actions, perhaps in part by glacial, they were brought into the shape of boulders at a time anterior to the deposition of the sedimentary mica schists.

And it is a fact of interest in this connection that the highly garnetiferous mica schists of this district, are charged with dodecahedral garnets, which probably have belonged to pre-existent rocks, inasmuch as their angles and edges are rounded off, and the crystals reduced to an almost globular form. This is true of the garnets while still firmly imbedded in the mica schists, and applies to the garnetiferous mica schists extending over a wide area.

On favorable report of the Committees, the following papers were ordered to be printed.

**Remarks on Dr. Asa Gray's notes on Buckley's new Plants of Texas.**

BY PROF. S. B. BUCKLEY.

In the spring of 1862 Dr. Asa Gray had two papers in the Proceedings of the Academy of Natural Sciences of Philadelphia, both of which were reviews of some new plants described by me in the same publication a few months previous. I left Philadelphia prior to the appearance of Dr. Gray's papers, being employed by the Sanitary Commission at Washington to make scientific examinations and measurements of Soldiers for anthropological purposes.—*See Anthropological Investigations of American Soldiers, by Dr. Gould*, lately published by the Sanitary Commission. At the end of the war I returned to Texas, where I have been ever since. I did not see Dr. Gray's notes till August, 1867. I have few Botanical works here, and no Herbarium, and have delayed to notice some points in which I think Dr. Gray has not done me justice, in hopes to be able to have a better chance than I have here, but as time is passing I will offer what facts I have now, leaving others for another opportunity.

During 1859, '60 and '61, I made a large collection of rare plants, in Georgia, Alabama, Mississippi, Louisiana and Texas, which I had boxed and started with for the North prior to the war. These were stopped and destroyed at Lavaca, Texas. They were intended for, and directed to, the Academy of Natural Sciences of Philadelphia.

The few I saved I brought with me, but I found the Herbarium of the Academy not as complete as I supposed. I expected to find all the plants which Nuttall had described, as well as full collections of Wright and other botanists who had explored Texas and other southwestern parts of our country. But these were not as full as I imagined, and the Library was deficient in some works which would have aided me in my investigations. I appreciate these facts more fully now, than I did then, and can understand how very likely it is that I have made some mistakes. There are very few botanists who have not had to regret similar errors under similar circumstances. Indeed the object of this paper is to show that Dr. Gray himself has fallen into error in many particulars in the papers in which he criticises mine. For instance, *Clematis Texensis*, Buckley, Dr. Gray says is his "*C. viorna* var. *coccinea*, Pl. Wr. 2 p. 7, *C. coccinea*, Engelman." It is referred to *C. viorna* with the remark that its "leaves are more glaucous, and the thick sepals of a pure carmine red, very rarely purplish." I do not know that Engelman has ever published his name of *C. coccinea*. I believe all that has been published is in the extract quoted. If, therefore, it is, as I have no doubt the majority of botanists will agree with me that it is, a distinct species from *C. viorna*, my name has the right by priority of publication. It grows in the vicinity of Austin.

1870.]

*Zanthoxylum hirtutum* Dr. Gray thinks but a variety of *Z. carolinianum*. There is a variety I know, and I suppose this is to what Dr. Gray refers. I am very familiar with it. It is abundant in the vicinity of Austin. But it is always small, the largest specimens with a trunk rarely exceeding three inches in diameter. This was a small tree, one foot at least in diameter, which attracted my particular attention by its very peculiar appearance, as I saw it on horseback in the vicinity of Corpus Christi. Its hairy leaves are a constant and distinctive character. I expect to get specimens again.

*Ampelopsis heptaphylla* Dr. Gray says is "a small leaved state of *A. quinquefolia*, with some of the leaves 6-7 foliate." They are all, or nearly all, 7 foliate. If *A. quinquefolia* were known to be variable in respect of the number of leaflets on the same plant, there might be room to look for a variety with another number of leaflets. But this species is noted for the regularity with which it bears five leaflets only, both in the north and in the south. It grows in the same locality with my *A. heptaphylla* constantly with five leaflets only. But this is not all: my plant not only has 7 leaflets almost constantly, they are smaller than *A. quinquefolia* and it flowers in cymose panicles at the end of April, while *A. quinquefolia* has compound racemes 3-4 inches in length and does not open its flowers till the middle or end of June.

*Vitis monticola*, he says, is *V. rupestris* of Schumacher. In *Plantæ Lindh.* 2, p. 11 Dr. Gray himself says of *V. rupestris*, "It does not climb but the stems are upright, and only two or three feet in height. This is right. I am familiar with it. But my *V. monticola* does climb, sometimes to the height of 15 feet. But in addition to this there is nearly two months difference in the time of opening of the fruit. All the inhabitants of this region readily distinguish them as different things.

*Vitis lanceolata* he refers to *V. labrusca*, and says that "the London specimen (of Dr. Hale) exactly agrees with what we formerly cultivated at Cambridge Bot. Garden as the Isabella grape." The Isabella grape is well known here, yet this is readily distinguished by the people of Texas, who call it the "Postoak grape." It has larger and less lobed leaves than Isabella. The Isabella has naturally but one short bunch—this is slender or branching; the berries drop easily from the stems—these are strongly adherent; the skin is rather thick and the berries comparatively large, while these are thin-skinned and smaller. The *V. labrusca* is a rampant species, this rarely grows 15 feet, and often bears fruit on bush-like specimens 3-4 feet high. I have studied both species very closely, both before and since Dr. Gray's criticisms, and can have no doubt of their distinctness.

*Vitis mustangensis* Dr. Gray says "is not the Mustang grape of Florida, but is the well known *V. candicans* of Engelman." He asserts further that *V. coccinea*, of Shuttleworth, is a thick leaved form of it, the *V. caribæa* of Chapm. whether of DeCandolle I am still uncertain. I believe the only description of *V. candicans* published, before my description of *V. mustangensis*, is the following from *Plant. Lindh.* 2, p. 166, where Dr. Gray says, "Under the name of *V. candicans* (N. S.) Engelm. med., I have from Lindheimer, as also from Wright, Texan specimens of what appears to be a variety of *V. californica* Benth., with the leaves somewhat less dentate, and more densely tomentose underneath." Again, in *Plant. Wrightiana*, p. 32, in a note at the bottom of the page, he states, "*Vitis candicans*, Engelm. med., which is also the *V. coccinea* of Shuttleworth, *Pl. Rugel. ex. sic.* from southern Florida, is not the same as *Vitis californica*, Benth., to which I was disposed to refer it in *Pl. Lindh.* 2, p. 166. Perhaps it may be *V. caribæa* of D. C." If this is, as I believe, the only description of *V. candicans* ever published, is Dr. Gray justified in terming it "well known?" Surely Dr. Gray does not own to much acquaintance with it, and makes no allusion whatever to its native name "mustang."

Dr. Gray "warns the reader that Mustang is not the name of a town."

country, as the termination *ensis* would imply, but of a wild horse." I may add that it is *also* the name of a stream along which this grape grows in great abundance.

I saw Lindheimer at New Braunfels in Texas in 1860. He told me that Gray and Engelman, with whom he was in close correspondence, were both uncertain about this grape, and that it was still undescribed. He regarded it as "scientifically unnamed." Under the rules of priority of description, I claim my name.

It is unlikely that my mustang grape is the *V. coriacea* of Shuttleworth, for be it remembered I had travelled extensively in Florida, and should have seen this grape there if they had been the same, but I never saw it in Florida; but the greater probability of this is that Chapman, who had resided in Florida 25 years, describes no such grape as mine, but refers the *V. coriacea* of Shuttleworth to *V. caribæa*, D. C., and further says the mustang of Florida is a form of *V. vulpina*. See Flora of Southern States, p. 71.

*Vitis bipinnata*, with which name the authority of "Torr. & Gray" is associated, belongs really to Willdenow.

*Astragalus Brazzensis*, Dr. Gray has, on a second examination, done me the justice to declare a good species.

*Hoopesia arborea* I am charged with "making up from a flowering specimen of *Cercidium texanum*, Gray, a fruiting one of *Acacia flexicaulis*, Benth, and a sterile branchlet of *Acacia rigidula*, Benth." Of course, no one would suppose I would mix plants purposely with the object of making a new genus or species. That no such a mixture was possible, I claim from the following facts. I was careful to select a large number of specimens with *both flowers and fruit on the same branches*. I also cut from sprouts which grew up from the base of the tree, so that I might have all its characteristics, for I felt then that it would prove to be undescribed. I spent a long time in getting these specimens. I was then engaged with Dr. Shumard in the geological survey of the state. Drs. Shumard and Riddell were then with me,—they in a buggy, I on horseback—at Corpus Christi together, and we started next day for Austin, my press and plants in the buggy. They went on hurriedly, agreeing to change my plants, I arrived in Austin three days after them, and found my plants mostly spoiled. I saved only a few damaged specimens of *Hoopesia*. Familiar as I was with them in cutting, and again in my anxiety a few days after to select from the damaged specimens the best left, I do not see the possibility of any mistake; but intend to take the first opportunity to visit again the locality, and get specimens for the Academy and other public institutions. Trees of the *Hoopesia* grow on the banks of the Gulf, from one to two miles below Corpus Christi.

*Dryera parviflora* and *Morus microphylla* are admitted to be good species.

*Juncus filipendulus* has also, since Dr. Gray's criticisms, been decided by Dr. Engelman to be a good species. But he has changed the name, on the ground that my name is "inappropriate." My name was suggested by the thread-like hanging stems of its fruit and flowers. Even were the name less appropriate than it manifestly is, if botanists had a right to change names to accord with each compiler's sense of fitness, how many synonyms should we not have?

*Juncus diffusissimus* Dr. Gray says is *J. debilis*. Dr. Engelman has since decided Dr. Gray to be wrong in this, but I have not Dr. Engelman's monograph by me to refer to what he decides it to be.

*Cyperus Heermanii* is not referred to any other species, and

*Elaecharis microformis*, though said to be "near intermedia," is probably a good species also.

For want of books and material, as I have before remarked, I am unable to follow up these corrections further; but finding myself right in so many which I have been able to reconsider, I hope to be able to clear myself from some of the other charges in future.

Dr. Gray was particularly severe in his preliminary remarks. He accuses me of a "gross appropriation and suppression of the names of Nuttall and others, as recorded in a public herbarium." The laws of botanical nomenclature say "a name which has never been clearly defined in some *public journal or work*, shall be changed for the earliest name by which the object shall have thus been defined." See *Edinburg Philosophical Jour.*, 1863--4. Indeed, in the language of science, a plant has not been named until it has been described in some "journal or work." One may by courtesy adopt a name he finds on a label attached to a herbarium specimen; but if in his opinion, from the smallness or imperfection of the specimen, or from other reasons, he believes the interest of science would be served by the use of another name in his description it is his duty to do so.

I feel that I have been wronged by Dr. Gray's personal remarks in his review of my papers. Considering such a course out of place in a scientific discussion, I have avoided anything like retaliation. But I have thought it due to me as the author, and the Academy as the publisher, of the papers criticized by Dr. Gray, that no more errors should be laid to their charge than they legitimately deserve.

---

**A New Classification of the North American FALCONIDÆ, with Descriptions of Three New Species.\***

BY ROBERT RIDGWAY.

INTRODUCTORY REMARKS.

Having been engaged for a considerable time upon an investigation of the North American Falconidæ, I have found it necessary to arrange the sub-families with their sections, the genera and their subgeneric divisions, in a manner somewhat different from the classification usually adopted. The following scheme is intended to express the arrangement that I have been led to make, as the result of the study alluded to.

Of course, the classification presented is based entirely upon the external anatomy, and may, very probably, be found to differ from one founded upon the internal structure. As however the former is more convenient for prac-

Family *FALCONIDÆ*.I. *Eye shaded by a projecting superciliary shield,\* covered with naked skin.*

A. Nostril circular, with a conspicuous central bony tubercle.†

a. Prominent tooth on commissure; lower mandible truncated, and with a deep notch corresponding with the tooth on the upper.

1. A web or membrane uniting the outer and middle toes at their bases.

*Falconinæ*.B. Nostril *not* circular, and without bony tubercle.a. A "ruff" or circle of short stiff feathers around the face, as in the *Strigidæ*.1. Membrane between toes well developed..... *Circinæ*.

b. No ruff.

1. Membrane well developed..... *Accipitrinæ*.2. Membrane rudimentary..... *Haliætinæ*.II. *No superciliary shield.*C. Middle toe longer than bare portion of tarsus in front..... *Milvinæ*.D. Middle toe shorter than tarsus in front..... *Polyborinæ*.‡I. *Eye shaded by a projecting superciliary shield, covered with bare skin.*

A. Nostril circular, with a central bony tubercle.

Subfamily *FALCONINÆ*.

Bill strong, its breadth at base equalling or exceeding its height; upper outline of cere rather lower than base of the culmen; gonys much arched, the chord of the arch equalling about half that of the culmen. Near the tip of the upper mandible is a prominent tooth on the commissure, and near the end of the lower mandible, which is truncated, is a deep notch corresponding; the end of the upper mandible is compressed, giving the situation of the tooth an inflated appearance when viewed from above. *Nostrils circular, with a conspicuous central tubercle.* Orbital region bare; projecting superciliary shield conspicuous, arched, but not very prominent. Tail shorter than wing, the feathers hard and stiff. Primaries very strong, elongated, tapering rapidly toward their points; only the first or first and second with their inner webs emarginated. Tarsus never with a single series of transverse scutellæ either in front or behind; middle toe very long.

*Diagnoses of generic and subgeneric divisions.*A. *Tarsus with no transverse scutellæ*, but, instead, covered with numerous irregular small scales; second quill longest; first always longer than fourth; only first emarginated on inner web.a. Middle toe *longer* than tarsus—the latter scarcely feathered below the knee. First quill equal to or *longer* than third.Genus *FALCO*, Auct.

1. First and second quills equal; outer web of second only sinuated; inner web of first emarginated; of second, sinuated.

Sp. *peregrinus*, Gmel., and "*anatum*," Bonap., (= *peregrinus* var. *anatum*).

\* This "shield" is formed by the bony process of the *lacrimal* projecting backward over the orbit. In *Falconinæ* (only) it consists of a single narrow process; in the other subfamilies, it is broader, and composed of two separate pieces, with cartilaginous junction, the posterior part or "hinged" plate forming the "shield."

† The only other American *Falconidæ*, having a similar nostril, are *Milvago*, *Phalcobuccas*, and, perhaps a few other genera, belonging to, or generally placed with, the *Polyborinæ*; they also have the tooth, notch, etc., of the bill decidedly indicated; other characters, however, separate them very widely from the *Falconinæ*.

‡ *Polybor* alone forms an exception; but the other characters of this genus are eminently *Polyborinæ*.

2. Second quill longest, but difference between first and second less than half that between second and third. Outer web of first and second sinuated; inner web of first emarginated; of none, sinuated.

*aurantius,\* rufularis.†*

- b. Middle toe shorter than tarsus, the latter closely feathered on upper portion; first quill shorter than third.

3. (Subgenus *Hierofalco*, Cuvier.) Outer webs of second, third and fourth quills sinuated (the last only perceptibly; ) inner web of first emarginated,—of second sinuated. More than the upper half of tarsus feathered, the feathering interrupted behind only by a narrow (almost concealed) strip from the knee downward.

*candicans,‡ islandicus,§ sacer,|| labradorus.¶*

4. (Subgenus *Gennasa*, Kaup.) Outer webs of second and third quills sinuated; inner web of first emarginated, of second sinuated. Only the upper third of the tarsus feathered; its posterior face and the whole knee bare.....*mexicanus.\*\**

- B. Front of Tarsus with a double series of transverse scutellæ, these alternately joining; second and third quills equal and longest—or, third longest; first and second with inner webs emarginated Tarsus scarcely feathered below the knee.

- a. (Subgenus *Hypotriorchus*, Boie.) Basal joint of toes with irregular scales.

5. Third quill longest; second and third with outer webs sinuated.

*columbarius††, richardsoni.‡‡*

- b. Basal joint of toes with transverse scutellæ.

6. Third quill longest; second, third and fourth with outer webs sinuated; scutellæ of tarsus and toes large and well defined, uninterrupted from knees to claws.....*femoralis §§*

7. (Subgenus *Tinnunculus*, Vieill.) Second and third quills equal and longest; second and third with outer webs sinuated.

*sparverius,||| (with all its varieties); sparveroides,¶¶ leucophrys.(1)*

- B. Nostril not circular, and without bony tubercle. Bill variable in form, but its breadth never equal to its height at the base; gonys only moderately convex No "tooth" on the commissure, but, in its stead, a more or less prominent "lobe" or "festoon;" lower mandible neither truncated nor notched. Nostril variable in form, but never circular, and never with a central bony tubercle; though there is sometimes a cartilaginous projection to be distinguished by its different appearance and

Subfamily *CIRCINÆ*.

A ruff of short, stiff, close feathers around the face, as in the owls. (*Strigidæ*.)

Genus *CIRCUS*, Lacépède.

Fine bristly feathers of the lores extending upwards above the cere. Bill rather weak, much compressed; upper outline of the cere forming an ascending plane, somewhat arched at posterior end. Nostril oval, horizontal; superciliary shield inconspicuous, though prominent. Tarsus more than twice the length of middle toe; very slender, the scutellæ distinct. Wing long.

1. Third and fourth quill equal and longest; second equals fifth; first shorter than sixth; second, third, fourth and fifth sinuated on outer webs; inner webs of outer four emarginated.

*C. hudsonicus*, (Linn.,) Vieill.

Subfamily *ACCIPITRINÆ*.

No ruff.

*A. Accipitres*. Bill much as in last; but less compressed and higher through the base; height at base exceeding chord of the culmen, the cere on top much ascending basally; commissure anterior to the festoon deeply scalloped. Nostril broadly ovate, obliquely horizontal. Toes very long. Wing short; fourth quill longest; second shorter than sixth; first equal to or shorter than the tenth; outer quill bowed; second to sixth (inclusive) sinuated on outer webs; inner webs of outer five emarginated. Tail long, but not equal to wing.

*a. Astur*, Lacépède. Upper half of tarsus feathered, the feathering scarcely interrupted behind, where the bare space is covered with small circular scales; base of toes and lower part of tarsus with only irregular small scales..... *A. atricapillus*, (Wils.,) Bonap.

*b. Accipiter*, Brisson. Less than one-third of the tarsus feathered below the knee; transverse scutellæ continuous all along the toes, and tarsus in front.

1. Middle toe longer than bare portion of tarsus in front; scutellæ of tarsus very distinct..... *A. Cooperi*, (Bonap.,) Gray.

2. Middle toe shorter than bare portion of tarsus in front; in adult birds, scutellæ of tarsus fused into an apparently-continuous plate, but in the young distinct..... *A. fuscus*, (Gmel.,) Bonap.

Bill stouter and less compressed than in preceding; feet robust; third to fourth quill longest.

*A. Tarsus* closely feathered to the toes.

*a. Aquila*. Toes (except terminal joint) with only small scales.

Genus *AQUILA*, Moehring.

Feathering of tarsus not interrupted behind; middle toe more than half as long as tarsus. Upper outline of cere parallel with lower. Nostrils narrow, oval, obliquely vertical; fourth quill longest; first shorter than seventh or eighth; five to seven quills sinuated on outer webs; five or six emarginated on inner. Feathers of the occiput and nape lanceolate.\*

Genus *ARCHIBUTEO*, Brehm.

Feathering of the tarsus interrupted behind by a narrow bare strip, exposing the knee; middle toe less than half as long as the tarsus. Upper outline of cere ascending basally. Nostril broadly oval, obliquely horizontal; fourth, or third and fourth quills longest; first shorter than seventh; second to sixth (inclusive) quills sinuated on outer webs; four or five emarginated on inner webs. Feathers of occiput and nape normal. Chin with a slight tuft of bristly feathers projecting forward.

\* Including all the European, as well as the American species.

## Genus ELANUS, Savigny.

Bill rather small and narrow, the tip normal; commissure moderately sinuated; upper outline of lower mandible greatly arched, the height at base less than half that through middle; gonys almost straight, declining downward toward tip. Nostril circular, in middle of cere. Tarsus and toes (except terminal joint) covered with small roundish scales; *under surface of claws just perceptibly flattened*; sharp lateral ridge on middle claw very prominent; a very slight membrane between outer and middle toes. 2d quill longest, 3d very slightly shorter; 1st just exceeding 4th; 2d and 3d with outer webs slightly sinuated; inner web of 1st emarginated, of 2d sinuated. Tail peculiar—emarginated—but the lateral feather much shorter than the middle, the one next to it being the longest..... *E. leucurus*, (Vieill.) Bonap.

b. *Claws flattened, or slightly grooved, beneath.*

## Genus NAUCLERUS, Vigors.

Bill as in preceding, but less deep and less compressed; gonys straighter. Nostrils oval, obliquely vertical. Toes with transverse scutellæ to their base; scales of tarsus large; lower edges of claws sharp; middle claw bent laterally, the inner side much arched, the edge sharp; a just distinguishable membrane between outer and middle toes. 3d quill longest, 2d scarcely shorter; 1st slightly exceeding 4th; 2d and 3d with outer webs just perceptibly sinuated, the cuttings near the end. *Tail excessively forked*, the latter feather more than twice as long as the middle ..... *N. forficatus*,\* (Linn.) Ridgw.

B. *Front of tarsus with transverse scutellæ.*

## Genus ICTINIA, Vieillot.

Bill peculiar, being very short and deep, the commissure with a heavy festoon, behind and in front of which is a more or less perceptible indentation; gonys convex, *ascending* toward tip. Nostril very small, circular. Membrane between outer and middle toes well developed. Claws short, robust, flattened beneath, the edges sharp, particularly that on the inner side of the middle claw, which is somewhat bent. 3d quill longest.

1. 2d quill much longer than 4th; outer webs of quills not sinuated; inner web of 1st emarginated, of 2d sinuated.

*I. mississippiensis*, (Wils.) Gray.

2. 2d quill much shorter than 4th, outer web of 2d and 3d sinuated near bases, inner web of outer three emarginated.

variable, but with the tip only slightly developed, and the commissure very regular. *Color of the bill greenish, or yellowish, white.* 3d or 3d and 4th quills longest; outer four to six sinuated on outer webs; inner webs of outer four or five sinuated.

Genus POLYBORUS, Vieillot.

Nostril in the upper anterior angle of the cere, *very small, linear, obliquely vertical, the posterior end being the upper one.* Cere very narrow, its anterior outline vertical and straight; commissure nearly straight; bill very high and much compressed. Occipital feathers elongated.

1. 3d quill longest; 1st shorter than 7th; outer webs of 2d to 5th (inclusive) emarginated at bases; inner webs of outer four emarginated.

*P. auduboni*, Cass., and *P. tharus*, Mol.\*

FALCO (HYPOTRIORCHIS) RICHARDSONII.

*Falco (Hypotriorchis) richardsonii*, Ridgway.

*Falco asalon*, Rich. and Swains., Faun. Bor. Am. ii, pl. 25, 1831. Coues, Prod. Orn. Ariz. Ter. (Pr. A. N. S. Phil.) 1866, p. 6 (in text).

*Hab.* Interior region of N. Am., from Arctic America southward, between Rocky Mts. and Mississippi valley, to Texas.

*Adult Male.* (Smithsonian No. 5171, Mouth of the Vermilion River, near the Missouri, Oct. 25th, 1856, Lt. G. K. Warren—Dr. F. V. Hayden). Upper plumage dull earth brown, each feather grayish umber centrally, and with a conspicuous black shaft line. Head above approaching ashy white anteriorly, the black shaft-streaks being very conspicuous. Secondaries, primary-coverts and primaries margined terminally with dull white; the primary-coverts with two transverse series of pale ochraceous spots; primaries with spots of the same, corresponding with those on the inner webs. Upper tail-coverts tipped, and spotted beneath the surface, with white. Tail clear drab, much lighter than the primaries, but growing darker terminally, having basally a slightly ashy cast; crossed with six sharply defined, perfectly continuous bands (the last terminal) of ashy white. Head, frontally, laterally and beneath—a collar around the nape (interrupting the brown above)—and the entire lower parts, white, somewhat ochraceous, this most perceptible on the tibia; cheeks and ear-coverts with sparse, fine hair-like streaks of black; nuchal collar, jugulum, breast, abdomen, sides and flanks with a medial linear stripe of clear ochre brown on each feather; these stripes broadest on the flanks; each stripe with a conspicuously black shaft-streak; tibia and lower tail-coverts with fine shaft-streaks of brown, like the broader stripes of the other portions. Chin and throat, only, immaculate. Lining of the wing spotted with ochraceous-white and brown, in about equal amount, the former in spots approaching the shaft. Inner webs of primaries with transverse broad bars of pale ochraceous—eight on the longest. Wing-formula, 2, 3—4, 1. Wing, 7.70; tail, 5.00; culmen, .50; tarsus, 1.30; middle toe, 1.25; outer, .85; inner, .70; posterior, .50.

*Adult Female.* (58983, Berthoud's Pass, Rocky Mts., Colorado Ter., Dr. F. V. Hayden—Jas. Stevenson.) Differing in coloration from the male only in the points of detail. Ground color of the upper parts clear grayish drab, the feathers with conspicuously black shafts; all the feathers with pairs of rather indistinct rounded ochraceous spots, these most conspicuous on the wings and scapulars. Secondaries crossed with three bands of deeper, more reddish ochraceous. Bands of the tail pure white. In other respects exactly as in the male.

Wing formula, 3, 2—4—1. Wing, 9.00; tail, 6.10; culmen, .55; tarsus, 1.40; middle toe, 1.51.

*Young Male.* (40516, Fort Rice, Dakota, July 20, 1865, Brig.-Gen. Alfred

\* South Am. Analogue of *P. auduboni*.

Sully, U. S. A., S. M. Rothhammer.) Differing from the adult only in degree. Upper surface with the rusty borders of the feathers more washed over the general surface; the rusty ochraceous forms the ground color of the head—paler anteriorly, where the black shaft-streaks are very conspicuous; spots on the primary coverts and primaries deep reddish ochraceous; tail bands broader than in the adult, and more reddish; the terminal one twice as broad as the rest ( $\cdot 40$  of an inch) and almost cream color in tint.

Beneath, pale ochraceous, this deepest on the breast and sides; markings as in the adult, but anal region and lower tail-coverts immaculate; the shaft-streaks on the tibia, also, scarcely discernible. Wing, 7.00; tail, 4.60.

It is to this perfectly distinct species, that the various citations of "*assalon*" from North America are to be referred. It is the bird noticed under that name in the "*Fauna Boreali Americana*," to the author of which (by whom its distinctness from *columbarius* was first recognized) we take pleasure in dedicating the species. This bird appears to inhabit exclusively the interior regions of North America, especially that portion between the Mississippi Valley and the Rocky Mountains; whether it extends into the Middle Province we cannot at present tell. Numerous specimens are in the collection from various points between Texas and the northern boundary of the U. S.—its habitat extending into the interior of British America, as we know from Richardson's account. The very numerous specimens of the *H. columbarius* from the same region as that inhabited by the present species, are of the usual style of that bird, and the slight degree of variation manifested in an exceedingly large series of the common species, as noted in its account,\* will, we trust, illustrate the wide separation of the two species, even in the most similar stages of plumage.

Comparative Characters of *HYPOTRIORCHIS COLUMBARIUS*, (Linn.) Gray, *ASSALON*, (Gmel.) Gray, and *RICHARDSONII*, Ridgway.

A. Adult males ashy blue above.

1. *COLUMBARIUS*. (Hab. Whole of N. Am.; West Indies.)

*Male*. Inner webs of primaries with eight transverse spots of white. Tail tipped with white, and with three, more or less continuous, black bands, anterior to the subterminal zone; lateral feather approaching to white on inner webs, on which there are altogether five sharply defined transverse spots of black, these crossing the shaft nearly to edge of outer web. Streaks on cheeks fine and sparse, pectoral markings broad, clear brown with black shaft-

*Female.* Above, *brownish plumbeous*, lighter and more bluish than in *columbarius*, feathers becoming *rusty toward margins*, and with more conspicuous black shaft-lines. Tail with *eight* narrow bands of fulvous-ashy, the first three concealed. Primaries with *ten* transverse oval spots of pinkish-ochre on inner webs, and indications of corresponding light spots on outer webs of inner quills. Conspicuous "moustache," as in the male.

Measurements of ♀. (Germany.) Wing, 9.00; tail, 5.70; tarsus, .95; middle toe, 1.15.

B. *Adult male brown like the female.*

3. RICHARDSONII. (*Hab.* Interior of N. Am.

*Male.* Much lighter, more *earthy* brown than females of two preceding. Head very light colored, above, approaching white anteriorly; cheeks with the streaks exceedingly fine and scattered. Tail crossed with *six* sharply defined, perfectly continuous bands of ashy white. Inner webs of primaries with *eight* whitish spots. Pectoral markings broad, sharply defined, *clear light ochraceous-brown*, with black shaft-lines, stripes broadest on the flanks.

*Female.* Generally similar to the male. All the feathers above with pairs of rounded ochraceous spots on opposite webs; *secondaries crossed with three bands of ochraceous*; bands of the tail pure white, *six* in number.

Measurements of ♀. (58983, Colorado Ter.) Wing, 9.00; tail, 6.10; tarsus, 1.40; middle toe, 1.51.

#### FALCO (TINNUNCULUS) LEUCOPHRYS.

*Tinnunculus leucophrys*, Ridgway.

*Tinnunculus sparveroides* (not of Vigors!), Lawrence, Ann. Lyc. N. Y. 1860, p. 1. (In part; light individuals.)

*Falco sparverius* (not of Linn.!), D'Orb., R. Sagra, Hist. Nat. Cuba, p. 25 (probably). Vig., Zool. Journ. I, 339; III, 435.

*Hab.* Cuba and Santo Domingo.

*Adult Male.* (34244, Remedios Cuba, Dec. 14, 1863, N. H. Bishop.) Head above pure, fine bluish ash, becoming (broadly) white on forehead; the feathers with delicate shaft-lines of black. Nape, back, scapulars, rump, upper tail-coverts and tail rich purplish rufous (almost exactly as in *sparverius*); no bars on dorsal region, except a very few across ends of larger posterior scapulars. Terminal band of tail *light rufous*, .30 in width; subterminal zone of black, very regular, .55 in width; lateral feather, with outer web and end of inner, reddish white, the black subterminal band crossing the inner web only; inner web anterior to this, continuous rufous; shafts of tail feathers rufous.

Wings fine bluish ash, like the crown; middle and lower coverts with a very few elliptical, *longitudinal* specks or touches of black on the shafts; secondaries passing terminally into white, their exposed basal half pure black; primaries pure black, exposed edges of inner webs paler.

Whole under surface of wings immaculate pure white, with a faint delicate reddish tinge; inner webs of primaries serrated along the shaft with dusky.

Forehead and superciliary stripe (broadly and sharply defined against the bluish of the crown,) whole side of the head (including lores and ear-coverts) and entire lower parts, continuous, *immaculate*, pure white, with a delicate orange tinge, except anteriorly.

The "moustache" is but just indicated by some blackish touches, and in some individuals it is wanting entirely, while in all it is very restricted in width; the other black *picturæ* of the head are, however, as in *sparverius*.

Wing formula 2, 3—4, 1. Wing, 7.00; tail, 5.00; tarsus, 1.30; middle toe, .90; culmen, .46.

A specimen in Mr. Lawrence's collection, which with others he has kindly lent me for examination, is in beautifully high plumage. It differs from the 1870.]

type in having the white of the lower parts tinged, or rather *stained*, with a beautiful, delicate *rufous* or almost a *salmon-orange*. The terminal band of the tail also inclines decidedly to this color, while the white of the under surface of the wing (particularly towards ends of secondaries and primaries) is tinged with a more pinkish shade of the same.

Another of Mr. Lawrence's specimens differs in the clearer white beneath (that is, with less reddish tinge—the pureness and continuity does not vary)—which extends entirely around the neck, giving a sharper definition to the black *picturæ*. The "moustache," however, is almost entirely absent; the black transverse spots on larger posterior scapulars are rather more conspicuous, and the terminal band of the tail is more purely white.

*Adult Female.* (31984, Cuba, J. Ackhurst.) Generally similar to *sparverius*, but rufous brighter, the bars narrower and less numerous, the nape or upper part of back, and rump being almost immaculate. Tail with ten black bars, these scarcely touching the shaft; the last is about .36 wide, the others about .16; tip of tail scarcely paler than base; lateral feather with outer web edged broadly with paler or ochraceous white, rufous next the shaft; immaculate; inner web with only 3 or 4 very narrow bars on terminal half. Head as in the male, but vertex considerably tinged with rufous.

Whole lower parts, including frontal and lateral regions of the head, continuous, pure white; breast with a very faint yellowish tinge; side of the breast and sides with a few scattered minute elliptical, longitudinal flakes of rusty—more black on the shaft. Whole under surface of the wing white, as in the male.

Wing formula, 2, 3—4, 1. Wing, 7.00; tail, 4.70; tarsus, 1.40; middle toe, .90; culmen, 51.

A Cuban female belonging to Mr. Lawrence is exactly similar. One in the S. I. Collection, from Hayti (43420, Port au Prince, June 5th, 1860, A. C. Younglove), differs only in less purely black bars, and in utter absence of the moustache. A male from the same locality (43418) is like it in the last respect.

After having carefully examined quite a large series of *Tinnunculus* from Cuba and San Domingo, I feel compelled to recognize two distinct species, of which the present is presented as new, although it has frequently been noticed; but only, however, in connection with the *sparveroides*, with which it has been confounded. The diagnosis will I hope sufficiently explain my reasons for separating these two birds.

pure black spots on side. *Female*.—Rufous more *vinaceous* than in preceding; markings beneath deeper brown.....var. *australis*.\*

A. Head above, and wings, dark bluish plumbeous; several outer tail-feathers variegated.

1. *Vertex without rufous*. *Male*.—Anterior portions beneath, deep, soft ochraceous; black spots very sparse; black zone of tail one inch wide; black bars above confined to larger scapulars. *Female*.—Black bars above broader, and purer black, than in either of preceding, upon a more ferruginous ground.....var. *isabellinus*.†

14. *Vertex with a rufous patch*. *Male*.—Black spots beneath numerous, large, circular; black bars above covering whole rufous surface. Tail with indications or more or less complete narrow black bands nearly to the base. *Female*.—Similar to that of preceding, but markings beneath more numerous, and pure black instead of brownish.

var. *dominicensis*.‡

c. Head above dark slaty plumbeous; outer tail-feather unvariegated.

1. ? (possibly 2). *No rufous on vertex*. *Male*.—Tail continuous rufous to its extreme tip; crossed with a broken black zone narrower than the terminal rufous; outer feathers without black.....var. ? *cinnamominus*.§

B. Whole lower parts and under surface of wings continuous immaculate white; inner webs of primaries with merely serrations of dusky along the shaft. A very sharply defined, broad, superciliary stripe of white.

2. *Male* resembling *sparverius*, except as above mentioned; "moustache" obsolete. *Female* differing from that of *sparverius* as does the male.

*leucophrys*.||

C. Whole lower parts deep dark rufous; inner webs of primaries slaty, with transverse dusky cloudings.

3. *Male*.—Whole upper surface plumbeous; tail deep chestnut, with a broad black subterminal, and narrower slate-colored terminal bar. *Female*.—The upper plumage considerably resembling that of the foregoing species, the lower parts, however, deep rusty rufous.

*sparveroides*.¶

#### ONYCHOTES GRUBERI, Ridgway.

Hab.—California ?

Sp. Ch. *Immature* ? (41,703 "California," F. Gruber.) \*\* Outstretched feet

\* *Fulco gracilis* (not of Lesson !), Swains., An. Menag. p. 281, 1838. *Fulco sparverius* (not of Linn.), Tschudi, Faun. Per. An. p. 110. *Tinn. sparv.* (not of Vieill.), Darw., Zool. Beag. pt. 1, 29. *Bidens dominicensis* (not *F. dom.* of Gmel. !), Spix, Av. Bras. I, 16. *Tinn. dom.*, Strickl., Orn. Syn. I, 100 (in part). *Tinnunculus sparverius* var. *Australis*, Ridgway. (Hab. Whole of Continental South Am. except the north Atlantic coast, where replaced by the var. *isabellinus*; in Chili and western Brazil mixed with var. (?) *cinnamominus*.)

† *Fulco isabellinus*, Swains., An. Menag. p. 281, 1853. *Tinnunculus dominicensis* (not of Gmel. !), Strickl., Orn. Syn. I, 100 (in part only). *Tinnunculus sparverius* var. *isabellinus*, Ridgway. (Hab. North Atlantic coast region of S. Am.; Caribbean and Gulf coasts of Middle Am., and Gulf coast of U. S. through Texas and Louisiana to Florida.)

‡ *Aspiter zealon dominicensis*, Briss., Orn. I, 399, pl. 32, f. 2, 1760. *Fulco dominicensis*, Gmelin, Syst. Nat. p. 285, 1789. *Tinn. dom.*, Strickl., Orn. Syn. I, 100, 1855 (in part only). *Tinnunculus sparverius* var. *dominicensis*, Ridgway. (Hab. Lesser Antilles, north to Porto Rico and St. Thomas.)

§ *Fulco cinnamominus*, Swains., An. Menag. p. 281, 1838. *Precilornis cinnam.*, Kaup, Monog. Falc. Cont. Orn. 1850, p. 53. *Tinnunculus cinnamomeus*, Gray, Gen. B. fol. sp. 11, 1844. List B. Brit Mus. p. 62. Bonap., Consp. Av. p. 27. Strickl., Orn. Syn. I, 100, 1855. (Hab. Chile and (western ?) Brazil.)

|| *Tinnunculus leucophrys*, nobis, page 147. (Hab. Cuba and Hayti.)

¶ *Fulco sparveroides*, Vigors, Zool. Journ. III, 436, 1827. *Tinn. sparr.*, Lawrence, Ann. Lyc. N. Y. 1860, p. 1 (in part only; dark specimens). *Tinnunculus dominicensis* (not of Gmel. !), Gundlach, Rept. Cuba, I, 225, 1865. *Hypotriorchis ferrugineus*, Sauss., Rev. et Mag. Zool. 1859, p. 117, pl. 3. (Hab. Cuba—only ?)

\*\* For generic characters, see page 142.

reaching beyond tail. General plumage dull dark bistre, darkest on the head above and back; the posterior lower parts paler and more reddish; throat and neck much tinged with pale rusty; this obsoletely bordering the feathers, which here have fine whitish filaments attached to the shafts; primaries uniform black. Tail like the rump, but with a more hoary tinge, (not paler at the tip,) and crossed with seven or eight very narrow obscure bars of darker, the last of which is distant an inch or more from the end. Lining of wing dark bistre, much tinged with rusty, this prevalent toward the edge; under surface of primaries white anterior to their emargination, beyond which they are ashy, approaching black at ends; ashy portion with distant, very obsolete dusky bars. No white anywhere about the head or neck.

Wing, 10.00; tail, 5.80; tarsus, 2.70; middle toe, 1.40; inner, .90; outer, 1.10; posterior, .80; hind claw, 1.00 (chord); inner claw, .91; on front of tarsus, 12 exposed, large transverse scutellæ; only 1.70 of the tarsus exposed.

This very peculiar hawk is, in all respects, utterly unlike any other American species. So much does it differ in structure, that we do not feel sure that it is not from some portion of the Old World, instead of from California.

However, we have searched in vain for descriptions which might apply to it, and have also examined, but without success, the large collection of exotic, as well as American, species in the museum of the Philadelphia Academy.

We take pleasure in dedicating this apparently-new species to Mr. Gruber, the collector and donor of the specimen, this gentleman, who is a zealous naturalist and accomplished taxidermist of San Francisco, having added much to our knowledge of the birds of California, through the frequent contribution of valuable specimens.

The following reports were read and referred to the Publication Committee:

#### LIBRARIAN'S REPORT.

The Librarian respectfully reports that the number of additions to the Library from Jan. to Dec. 1870, inclusive, amounts to 1226.

Of these 128 were volumes, 970 pamphlets and 127 newspapers, maps and photographs. They were derived from the following sources:

Societies, 497; Editors, 319; Wilson Fund, 122; Authors, 101; Norwegian Government, 19; Geological Survey of Sweden, 11; Chilean Government, 11; Publishers, 8; Elias Darard, 7; Geological Survey of India, 6; Thos. Mathew, 5; Museum of Paris, 4; Waterbury, 3; Geological Survey of

Elliott's Birds of North America, and the remainder were disposed of at auction in New York for \$100.00.

I take this opportunity of again calling your attention to the expediency of selling the valuable Fine Art and literary works now in the Library. If this plan be adopted the means at the disposal of the Library Committee for procuring books absolutely necessary to the working members of the Academy will be greatly increased.

Blank forms, for the use of those wishing to apply for new books, have been prepared by order of the Council, and will be ready for use by the beginning of the year.

All of which is respectfully submitted,

EDWARD J. NOLAN, *Librarian*.

## REPORT OF THE CURATORS.

The Museum of the Academy, in charge of the Curators, is in about the same condition that was indicated in the last annual report. The Conchological Section continues actively to arrange in order the large cabinet in its care. Other departments remain with but little progress towards arrangement.

The Curators regret to add that nothing further has been done, during the last year, towards completing the suggested plan of providing a new building for the accommodation of the Academy.

The Curators take pleasure in stating that the proposition, in their last annual report, to make a small charge of admission to the Museum, with the special view of moderating excessive crowds, having, with the authority of the Academy, been put into effect, has been found to meet all requirements. The charge of ten cents for each person, which was commenced the first of May, is so small as to be an inconvenience to no one really desirous of examining the Museum, while it is sufficient to prevent the crowds, which formerly were so great an annoyance. At the same time the income derived from the fees is found to be sufficient to keep the Museum in a proper condition of cleanliness and repair.

The donations during the year to the different departments of the Museum are as follows :

*Mammals*.—A mounted specimen of the Grizzly Bear, one of the Fisher, of California, and one of the Howling Monkey, from Honduras, presented by Dr. George Hewston, of San Francisco, Cal. Skin and skeleton of the Sea Lion, (*Eumetopius Stelleri*) from Cape Arenas, Cal., and several skins of smaller mammals from Alaska, presented by Dr. Geo. Davidson, U. S. Coast Survey.

*Birds*.—One hundred and fifty bird-skins from the West Indies, being types of the principal birds of the Antilles ; and nineteen other skins, presented by the Smithsonian Institution. A collection of bird skins from California and Alaska, presented by Dr. George Davidson.

*Reptiles and Fishes*.—A small collection of lizards and serpents from near Pensacola and Perdido R., presented by Dr. John M. Kollock. A collection of reptiles and fishes from California and Alaska, presented by Dr. George Davidson. A serpent from Kansas, presented by S. R. Roberts. A Trigonocephalus half swallowed by *Oxyrrhopus plumbeus*, from St. Lucia, W. I., presented by Mrs. Capt. James S. Endicott, of Somer's Point, N. J. A small collection of reptiles, presented by A. C. Craig.

*Mollusks*.—For donations see Conservator's Report of the Conchological Section.

*Articulates*.—A collection of Myriapods from Missouri, presented by Charles Veatch ; of Spiders in alcohol, by A. C. Craig ; a Centiped, from the Apure 1870.]

R. S. A., by Crawford Coates; and nests of the Trap-Door Spider, by Dr. George Davidson.

*Fossils*.—A choice collection of fossils, consisting of cetacean vertebrae, shark teeth, &c., from the Ashley River deposit, S. C., presented by Philip Wineman, through Messrs. Powers & Weightman. Two cetacean vertebrae and several shark teeth and a vertebra, from the same locality, presented by Col. D. W. Hagler, U. S. Arsenal, Georgia. A metacarpal of *Megalonyx* and a tooth of an extinct *Ox*, from Illinois, presented by Henry Greene and Dr. E. D. Kittos. Two fossil bones from Kansas, presented by Dr. W. F. McAllister; fragments of a fossil reptile bone, from Clarksville, N. J., by S. R. Roberts; and a large log of silicified wood, from Greenwich, N. J., presented by Dr. George B. Wood. A collection of fossil plants was also received from France, in exchange.

*Comparative Anatomy*.—Cranium of an Indian, from Greenwich, N. J., presented by Dr. George B. Wood; another specimen from near Woodbury, N. J., presented by George M. Tatum. Skull of a rat with distorted growth of an incisor tooth, presented by Richard L. Nicholson. Tusk of a Walrus, from Sitka, presented by Capt. George Wright, U. S. A.

*Botany*.—The herbarium of the late Thomas G. Lea, of Cincinnati, Ohio, presented by James M. Lea, with the condition that it shall be preserved separately as the "*Lea Herbarium*." A collection of upwards of one hundred species of plants from Alameda, Cal., presented by Dr. W. P. Gibbons. A collection of cones of forty-four species of conifers, presented by Josiah Hoopes, Thomas Meehan and I. M. Thorburn. Six species of ferns, from Venezuela, presented by Thomas Guckert. A small collection of marine algae, from Washington Ter., presented by Mrs. Samuel Stork, and another, from Ceylon, presented by Dr. A. C. Hamlin.

*Minerals*.—Two remarkably fine crystallized specimens of Epidote, from Untersulzbach, Tyrol, presented by Wm. P. Wilstach, a large crystal of Beryl, from Chester Co., Pa., presented by W. S. Vaux; and a fine mass of Graphite, from Ceylon, presented by T. Guilford Smith. The following specimens were also presented:—Calamine, Sussex Co., N. J., by Thomas S. Wiegand; Magnetic Iron, Essex Co., N. Y., by J. Blodget Britton; Margarite, Emery and Diaspore, Chester, Mass., by J. B. Taft; Zincite and Jeffersonite, Sussex Co., N. J., by Garret Kemble; Corundum in Lesleyite, Tourmaline, Muscovite and Oligoclase, Chester Co., and Phlogopite, Burgess, Canada, by Dr. Isaac Lea. Gold in slate, Montgomery, N. C., by Dr. F. A. Genth. Graphite, Del. Co., Pa., by Joseph W. Foster, and Dr. S. B. Hayden. Kyanite,

them were in other conditions than those which we already have, and have been added to the collection.

A collection from California, presented by Dr. Gibbons, has also been added, and added to the collection. Many of these we did not possess before.

The collection of Australian plants presented by Dr. Mueller a few years ago, besides scattering collections from Alaska and other parts, have been all gathered together in their respective natural orders. The cases containing the general *Herbarium* of the Academy are full, and numbered consecutively. No additions can be made until the whole is re-arranged. The collections above referred to are, therefore, for the present preserved separate, as a supplemental herbarium.

In the beginning of the year it was found that the plants in the magnificent Shortian Herbarium were being badly injured by insects. By authority of the Curators, Mr. Burk was engaged to poison them. He has since been steadily engaged on the work, which is about two-thirds completed.

All the plants in the collections before alluded to were poisoned before getting away by the labors of Mr. Burk.

THOMAS MEEHAN,  
*For Committee.*

REPORT OF THE RECORDING SECRETARY.

The Recording Secretary would respectfully report that, during the year ending November 30th, 1870, there have been elected thirty-seven members and five correspondents.

The death of the following members has been announced, namely:

Benj. D. Walsh, Mrs. E. H. Vaux, Caleb S. Hallowell, Wm. P. Wilstach, Richard Wood.

Four members have resigned.

The number of papers contributed and ordered to be printed in the Proceedings of the Academy and Medical Journals during the year has been nineteen, as follows:

|                                 |   |                         |   |
|---------------------------------|---|-------------------------|---|
| Elliott Coues, M. D.....        | 1 | Prof. Cyrus Thomas..... | 1 |
| C. F. Austin.....               | 1 | T. Hale Streets.....    | 2 |
| F. B. Meek & A. H. Worthen..... | 2 | Theodore Gill.....      | 1 |
| Prof. C. Johnson.....           | 1 | E. D. Cope.....         | 1 |
| Thomas Meehan .....             | 5 | H. M. Bannister.....    | 1 |
| F. B. Meek.....                 | 1 |                         |   |

In the Medical Journals, two, namely:

|                           |   |                  |   |
|---------------------------|---|------------------|---|
| S. W. Mitchell, M. D..... | 1 | James Tyson..... | 1 |
|---------------------------|---|------------------|---|

All of which is respectfully submitted,

S. B. HOWELL, *Recording Secretary.*

The Treasurer's report was read and referred to the Committee on Finance.

The Report of the Recorder of the Microscopical and Biological Section was received and referred to the Publication Committee.

The following is an extract from the same:

The great event in our history as an association, during the year which has just elapsed, was unquestionably the first Annual *Conversazione* held in the Hall of the College of Physicians, on the 12th of May, with a degree of success and satisfaction, not only to ourselves, as hosts, but also to our invited

guests, that has rarely, if ever, been equaled by any similar scientific reunion before held in this city.

It was followed early in June by an exhibition of microscopes and microscopical apparatus, given to the members of the State Medical Society, with almost equal eclat, and which probably aided largely to diffuse among the rural practitioners of our State an accurate knowledge of the immense strides made during the past few years in the various departments of Microscopical Science.

The new plan of constituting every alternate meeting a conversational one, determined upon in accordance with suggestions contained in the resolutions brought forward by Dr. R. S. Kenderline, in June last, has now been on trial for about three months, and, although its practical operation does not yet prove entirely without difficulties, it is to be hoped that greater care and farther experience will enable us to derive from this novel feature the marked advantages which it seems capable of affording us.

Before concluding my report I may advert to the new and agreeable field of usefulness, which has been opened to us through the relations of our parent Academy, with the Smithsonian Institution, at Washington, to wit: the reference of subjects requiring microscopical investigation to our department for examination and report: indeed, it appears to me that few opportunities of conducting towards a wide spread, enduring reputation, usefulness and influence for the Biological and Microscopical Section of the Academy, are more promising than those which invite our researches to matters of national interest and importance, such, for example, as the dust showers which occasionally visit our country. In fact, although in one respect, that of electing honorary and corresponding members, we may labor under certain restrictions on account of our connection with the Academy, so great and counterbalancing advantages are derived from this association that, to quote the words of our late Recorder, Dr. Tyson, in his last annual report, "We believe that any attempt to weigh them would result decidedly in favor of such union."

All of which is respectfully submitted,

JOS. G. RICHARDSON, *Recorder*.

---

## REPORTS OF THE CONCHOLOGICAL SECTION.

---

### RECORDER'S REPORT.

---

## CORRESPONDING SECRETARY'S REPORT.

To the Conchological Section of the Academy of Natural Sciences, Philadelphia:

The Corresponding Secretary would respectfully report that letters have been written as follows, viz.:

Jan. 10.—To Prof. A. E. Verrill, Yale College, New Haven.

Feb. 4.—To Dr. P. P. Carpenter, Montreal, C. W.

Dec. 1.—To Dr. Frederick Stoliczka, Calcutta.

Ralph Tate, London.

Albany Hancock, Newcastle-upon-Tyne.

Dr. Jno. Römer, Marbourg, Hesse.

Prof. Wm. H. Dall, Smithsonian.

The following letters have been received:

Feb. 3.—From Prof. H. Cross, Paris.

Dr. P. P. Carpenter, Montreal, C. W.

Dec. 1.—Jules Collican, Brussels.

Respectfully submitted,

E. R. BEADLE, *Corres. Sec'y.*

## LIBRARIAN'S REPORT.

The Librarian respectfully reports that there have been presented, during the past year, to the library of the Conchological Section, 104 pamphlets, 3 volumes and an almost complete suite of the publications of the Academy. Of these, 27 were received from Societies, 32 from Editors, 32 from Authors, 6 from Publication Committee, 6 from Geo. W. Tryon, Jr., 2 from Isaac Lea, 1 from Prof. Marsh, and 1 from P. P. Carpenter.

The Proceedings and Journal of the Academy were received from J. S. Phillips.

In addition, 26 pamphlets and continuations of Conchological works have been received through the Academy.

The work of transcribing the revised Catalogue of the Library has been carried on during the year as rapidly as circumstances would permit.

All of which is respectfully submitted.

EDWARD J. NOLAN, *Librarian.*

## CONSERVATOR'S REPORT.

The Conservator of the Conchological Section respectfully reports that the donations to the Cabinet, during the year, have been as follows:

From REV. E. R. BEADLE. Ten species of Mollusca, principally from St. Martin's, W. I.

H. P. CARPENTER. *Limnea columella*, Say, from Providence, R. I.

J. C. COX. One hundred and thirty-four species of Australian and Polynesian land, fresh-water and marine shells.

A. O. CURRIER. A collection of land and fresh-water shells from Nicaragua, including types of several new species forming part of the collections of the MacNiel Expedition to Central America. A collection of *Limnæidæ* and *Viviparidæ* from Kent County, Mich.

W. H. DALL. Two species of *Physa* from Arizona and Nicaragua. *Gadinia reticulata*, Say, from Monterey, Cal., and one unknown species of *Gadinia*.

H. A. GILLIAT. Fifty-seven species of Australian marine shells.

F. A. HANSLER, M. D. Model of animal of *Strombus gigas*, Linn. Suite of specimens of *Helix sphaerica*, Hartm., from Syria.

1870.]

F. V. HAYDEN, M. D. Six species of fresh-water shells, from Ancient Lake margins, Salt Lake, Utah.

G. A. LATHROP. Five species of *Helices* from Tennessee.

ISAAC LEA. Types of *Physa Carltoni* and eight species of *Unio* from Big Black River, Mis.

M. L. LEACH. *Pomatiopsis lapidaria*, Say, from St. Louis, Mich.

J. A. MCNEIL. *Unio Macneili* and a species of *Melania*.

M. McDONALD. *Leucocheila fallax*, Say, and *Triodopsis introfrens*, Bland, from Lexington.

F. B. MEER. *Tiara humerosa*, Meek, from Utah—fossil.

C. W. PHALE. Specimens of *Glandina*.

W. H. PRASE. *Melania Kanaiensis*, *Limnea rubella*, Lea, *L. turgidula*, *L. ambigu*, and *L. compacta*.

J. S. PHILLIPS. Two species of *Marginella*; *Aricia Scottii*, Brod.; *Porcellana erythraensis*, Beck.

J. H. REDFIELD. *Cyclophorus Nilagiricus*, Benson; fourteen species of *Auriculide*, eight species of *Ringicula*, and nine species of *Cylindrella*.

S. R. ROBERTS. *Helix alternata*, Say, from Niagara Falls.

REV. J. ROWELL. *Goniobasis circumlineata*, Tryon, and a species of *Physa*.

W. S. W. RUSCHENBERGER. Two specimens of *Spondylus Delessertii*, Chemn., from Navigator's Island.

MRS. LUDY W. SAY. A unique rayed specimen of *Unio cylindricus*, Say, from the Wabash river.

JOHN WOLF. *Pleurocera Lewisii*, and *P. subulare*, Lea, from Illinois River, Canton, Ill.; two species of *Physa*; two species of *Limnæidæ*; *Amnicola parva*, Lea, *A. rustica*, Say, and *A. decusa*, Hald., from Illinois; eleven species of *Unionidæ* and one of *Sphaerium* from Canton, Ill.

The following were purchased with funds received from the sale of duplicates: *Catulus hæmastoma*, from India; *Helix Skinneri*, Reeve, from Ceylon; twenty-eight species operculate land shells from West Indies, new to collection, named by Thos. Bland, and six species of *Cylindrella*.

A collection of one hundred and fifty-two species was sent to Sylvanus Hanley for shells received from him in 1869. A similar collection was sent in exchange to Dr. J. C. Cox, of Sydney, N. S. W.

Selections from the publications of the Section were sent in exchange to E. A. Bielz, of Hermannstadt F. de Malzine, of Bruxelles, E. von Martens, of Berlin, M. Pictet de la Saussure, of Paris, W. M. Pilsbry, of Hutton, Penn. Turner

The election of Officers for the ensuing year was held, in accordance with the By-Laws, with the following result:

|                                 |   |   |   |   |  |
|---------------------------------|---|---|---|---|--|
| <i>President,</i>               | . | . | . | . | W. S. W. Ruschenberger, M. D.  |
| <i>Vice Presidents,</i>         | . | . | . | . | Wm. S. Vaux,<br>Jos. Carson, M. D.   |
| <i>Recording Secretary,</i>     | . | . | . | . | Samuel B. Howell, M. D.  |
| <i>Corresponding Secretary,</i> | . | . | . | . | Edward D. Cope.  |
| <i>Librarian,</i>               | . | . | . | . | Edw. J. Nolan, M. D.   |
| <i>Treasurer,</i>               | . | . | . | . | Wm. C. Henszey.  |
| <i>Curators,</i>                | . | . | . | . | Joseph Leidy, M. D.,<br>William S. Vaux,<br>Geo. W. Tryon, Jr.,<br>Edw. D. Cope.                           |
| <i>Council,</i>                 | . | . | . | . | Isaac Lea,<br>Robert Bridges, M. D.,<br>Edw. S. Whelen,<br>Isaac Hays, M. D.                               |
| <i>Publication Committee,</i>   | . | . | . | . | Jos. Leidy, M. D.<br>Robert Bridges, M. D.,<br>Wm. S. Vaux,<br>Geo. W. Tryon, Jr.,<br>Edw. J. Nolan, M. D. |
| <i>Committee on Finance,</i>    | . | . | . | . | Wm. S. Vaux,<br>Aubrey H. Smith,<br>Robert Bridges, M. D.  |

## ELECTIONS FOR 1870.

---

Members and Correspondents of the Academy of Natural Sciences have been elected as follows for the year 1870:

### MEMBERS.

*Jan. 25.*—Charles T. Hunter, M. D.

*Feb. 22.*—Theodore L. Harrison, Jas. S. Martin, Chas. D. Reed.

*March 29.*—Geo. Hewston, of San Francisco, Cal., Alfred Tucker, W. Harrison Eisenbrey.

*April 26.*—John T. Morris, Dwight D. Willard, Daniel B. Smith.

*May 31.*—Thos. H. Speakman, H. St. G. Elliott, M. D., George Rice, Wm. H. Gumbes, Walter B. Comegys, Miss Grace Anna Lewis, Miss Hannah T. Smallwood, Miss Ella Hornor.

*Sept. 27.*—Wm. B. Rogers, Jr., Wm. H. Pancoast, M. D., Green Smith, of Cornell University, Thos. G. Gentry, Thos. Stewardson, H. Wier Workman.

*Oct. 25.*—J. Blodget Britton, J. Solis Cohen, M. D., Bushrod W. James, M.D., Chas. K. Mills, M. D.

*Nov. 29.*—J. Ewing Mears, M. D., Chas. Shaffner, M. D., E. Wildman, M. D., David L. Collier, Wm. H. Dougherty, W. H. Wahl, M. D.

### CORRESPONDENTS.

## CORRESPONDENCE OF THE ACADEMY, For 1870.

---

*January.*—Madame Charlotte Erdmann, announcing the death of Axel Joachim Erdmann:

Antonio Stoppani, announcing the death of Giuseppe Stabile.

J. F. Peck, in regard to white fish.

F. W. Putnam, in regard to the McNeil collection of reptiles.

P. E. Gibbons, in regard to a snake sent.

Geo. Davidson, with specimens sent.

H. E. van Rijgersma, in regard to specimens sent.

J. Hauxwell, in regard to arrival of boxes sent by the Academy.

Geo. Davidson, in regard to specimens sent.

Smithsonian Institution;

Kaiserliche Akademie der Wissenschaften in Wien; each acknowledging receipt of Journal.

Linnean Society;

British Museum;

Athenæum, Pall Mall;

Nassauischen Vereins für Naturkunde;

Naturforschende Gesellschaft des Osterlandes zu Altenburg; severally acknowledging receipt of Proceedings.

Königlich Bayerische Akademie der Wissenschaften;

Académie Royale des Sciences à Amsterdam;

Det Kongelige Danske Videnskabernes Selskab i Kjobenhavn;

Geological Museum of Calcutta; severally acknowledging receipt of Journ. and Proceedings.

Senckenbergische Naturforschende Gesellschaft in Frankfurt-am-Main; acknowledging receipt of Jour. and Proc. and sending Pub. in return.

Kaiserliche Akademie der Wissenschaften zu Wien;

Académie Royale à Amsterdam;

Société des Sciences de Finlande;

Universidad de Chile;

Naturforschende Gesellschaft in Emden;

Mannheimer Verein für Naturkunde;

Naturforschende Gesellschaft in Frankfurt-am-Main;

Société des Sciences Naturelles;

Aerztlichen Vereins in Frankfurt-am-Main;

Museets Naturhistoriske Afdeling Bergen, Norway;

Observatoire Physique Central; severally with publications.

*February.*—Daniel Turner, announcing the death of Dr. T. H. Turner.

Smithsonian Institution; acknowledging receipt of parcels for distribution.

James Orton, in regard to the purchase of books.

Wm. Smith, offering to collect for Academy.

W. E. Webb, in regard to footprints.

Smithsonian Institution, with birds from Henry Bryant's collection.

Wm. Smith, in regard to a snake.

J. E. Carey, in regard to a whale ashore.

Dr. W. Dunker, acknowledging receipt of books.

Legation Impériale de Russie aux Etats Unis, with Geological map.

Academy of Sciences of Chicago;  
 Essex Inst.;  
 N. Y. State Library; severally acknowledging receipt of Proceedings.  
 Essex Inst.;  
 Smithsonian Inst.;  
 American Antiquarian Society;  
 Lyceum of Natural History;  
 N. Y. State Library; severally acknowledging receipt of Journal.  
 Library of Congress, acknowledging receipt of Jour. and Proc.  
 K. K. Zoologisch-botanische Gesellschaft in Wien;  
 Kaiserliche Akademie der Wissenschaften in Wien;  
 Société Hollandaise à Harlem; severally with publication.

*March.*—Smithsonian Inst., with rules for sending packages.  
 James M. Lea, presenting the herbarium of Thomas G. Lea.  
 Chas. F. Hall, in regard to Arctic voyage.  
 Naturforschende Verein in Brünn,  
 Academy of Sciences of Chicago;  
 Smithsonian Inst.; severally acknowledging receipt of Proc.  
 Smithsonian Inst.; acknowledging receipt of Journal.  
 American Antiquarian Society, acknowledging receipt of Jour. and Proc.  
 Akademie der Wissenschaften München;  
 Société Royale Hongroise des Sciences Naturelles;  
 Institution Royale Meteorologique Pays-Bas; severally with publications.

*April.*—Smithsonian Inst.;  
 Lyceum of Natural History; each acknowledging receipt of Proc.  
 British Museum, acknowledging receipt of Jour. and Proc.  
 Geological Museum of Calcutta;  
 Société Entomologique de France;  
 Naturwissenschaftliche Verein zu Bremen; severally with publications.

*May.*—Smithsonian Inst., presenting birds.  
 R. Instituto di Scienze Lettere ed Arti in Venezia, acknowledging receipt of Proceedings.

Gesellschaft der Wissenschaften Prag, acknowledging receipt of Journal.  
 Zoological Society of London;  
 Royal Society of London; each acknowledging receipt of Jour. and Proc.  
 Société Royale de Zoologie à Amsterdam;  
 Société des Sciences Naturelles de Milan;

*September.*—W. Webster Butterfield, M. D., asking for copies of By-laws and list of Members.

Magyar Tudományos Akademia Pest, acknowledging receipt of Proc.

*October.*—H. Weir Workman ;

Wm. B. Rogers, Jr. ;

Greene Smith ; severally acknowledging election as members of the A. N. S. A. E. Buck, in regard to a lamprey eel.

Smithsonian Inst., acknowledging receipt of box.

American Geographical and Statistical Society ;

Museum at Bergen, Norway ;

California Academy of Sciences ;

Athenaeum Pall Mall ;

Lyceum Natural History ; severally acknowledging receipt of Proceedings.

Naturforschende Gesellschaft in Emden, with publications.

*November.*—Temple C. Harrison, asking for copy of By-laws.

British Museum ;

Anthropological Society of London ; each acknowledging receipt of Proc.

Koninklijke Natuurkundige Vereeniging in Nederlandsch-Indie à Batavia ;

Det Kongelige Danske Videnskabernes Selskab Copenhagen ; each with publications.

Number of letters received 1870, 127.

“ “ “ written “ 65.

Number of members elected, 37.

“ “ correspondents, 5.

EDWARD D. COPE

*Corresponding Secretary.*

## DONATIONS TO THE LIBRARY.

### 1870.

---

### JOURNALS AND PERIODICALS.

#### SWEDEN.

- Christiania.** Forhandlingar i Videnskabs-Selskabet i Christiania. Aar, 1868. From the Society.
- Forhandlingar ved de Skandinaviske Naturforskernes Tiende Möde i Christiania fra den 4de til den 10de Juli, 1868. From the Society.
- Det K. Norske Frederiks Universitets Aarsberetning for Aaret, 1868. From the Society.
- Nyt Magazin for Naturvidenskabernes udgives af den physiographiske Forening i Christiania. 6de Bind, 1, 2, 3 and 4 Hefte. From the Society.
- Norske Meteorologisk Aarvog for 1868. 2den Aargang. From the Observatory.

#### DENMARK.

- Copenhagen.** Mémoires de la Société Royale des Antiquaires du Nord. Nouvelle Série. 1868 and 1869. From the Society.
- Oversigt over det K. danske Videnskabernes Selskabs. 1868, Nos. 5 and 6; 1869, Nos. 2, 3 and 4; 1870, No. 1. From the Society.
- Tillæg til Aarbøger for Nordisk Oldkyndighed og Historie. Aargang, 1869. Udgivet af det K. Nordiske Oldskrift Selskab, 1870. From the Society.

- Annales de l'Observatoire Physique Central de Russie** publiées par H. Wild. Année, 1865. From the author.
- Jahresbericht des Physikalische Central-Observatoriums für 1869.** Von H. Wild, 1870. From the Editor.
- Mémoires de l'Académie Impériale des Sciences.** 7e Série. Tome XIII, No. 8, to Tome XV, No. 8. From the Society.
- Bulletin de l'Académie Impériale des Sciences.** Tome XIV, No. 1, to Tome XV, No. 2. From the Society.

## HOLLAND.

- Amsterdam.** Jaarboek van de K. Akademie van Wetenschappen, gevestigd te Amsterdam. 1868. From the Society.
- Hague.** Archives Néerlandaises des Sciences Exactes et Naturelles. Tome IV and Tome V, Nos. 1, 2 and 3. 1870. From the Publishing Society.
- Utrecht.** Nederlandsch Meteorologisch Jaarboek voor 1869. 21er Jahrg. 1ste Deel. 1869. From the Meteorological Institute.

## GERMANY.

- Altenburg.** Mittheilungen aus dem Osterlande. 19er Band, 1es und 2es Heft 1869. From the Publishing Societies.
- Berlin.** Archiv für Naturgeschichte. 35er Jahrg., No. 2, to 36er Jahrg., No. 2. 1869. From the Editor.
- Berliner Entomologische Zeitschrift.** Herausgegeben von dem Entomologischen Vereine. 13er Jahrg., 1869, 3es and 4es Vierteljahresheft. 1870, 1es and 2es Heft. From the Society.
- Monatsbericht der K. P. Akademie der Wissenschaften.** Nov., 1869, to Juli, 1870. From the Society.
- Zeitschrift der Deutschen Geologischen Gesellschaft.** XXI Band, 4 Heft, to XXII Band, 3 Heft. From the Society.
- Zeitschrift für die Gesammten Naturwissenschaften.** Herausgegeben von dem Naturw. Vereine für Sachsen und Thüringen in Halle. Jahrg., 1869. 33er und 34er Band. Neue Folge, 1870. Band 1. From the Society.
- Sitzungs-Bericht der Gesellschaft Naturforschender Freunde.** Jahre, 1869. From the Society.
- Wochenschrift des Vereines zur Beförderung des Gartenbaues in den K. P. Staaten für Gärtnerei und Pflanzenkunde.** XII Jahrg., 1869. From the Editor.
- Bonn.** Verhandlungen des Naturhistorischen Vereines der Preussischen Rheinlande und Westphalens. 26er Jahrg., 3e Folge. 6 Jahrg., 1 and 2 Hefte. 1869. From the Society.
- Braunschweig.** Archiv für Anthropologie. 4er Band, 1870, 1es und 2es Vierteljahrsheft. From the Wilson Fund.
- Bremen.** Abhandlungen herausgegeben vom Naturwissenschaftlichen Vereine. 2 Bd., 2 Heft. 1870. From the Society.
- Brün.** Verhandlungen des Naturforschenden Vereines in Brün. VII Band. 1868. From the Society.
- Cassel.** Journal für Ornithologie. XVII Jahrg., Heft VI., XVIII Jahrg., Heft I, II and III. 1869—1870. Purchased.
- Dresden.** Sitzungsberichte der Naturwissenschaftlichen Gesellschaft Isis in Dresden. Jahrg., 1869, No. 7, to 1870, Juni. From the Society.
- Euden.** Vierundfünfzigster und 25er Jahresbericht der Naturforschenden Gesellschaft. 1868—1869. From the Society.
- Frankfurt, A. M.** Der Zoologische Garten. X Jahrg., 1869, No. 7, to XI Jahrg., 1870, No. 6. From the Editor.
- Jahresbericht neber die Verwaltung des Medicinalwesens der Stadt Frankfurt, A. M.** X Jahrg. 1866. From the Publishing Society.

- Abhandlungen, herausgegeben der Senckenbergischen Naturforschenden Gesellschaft. 7en Bandes, 1es and 2es Heft. 1869. From the Society.
- Berichte über die Senckenbergische Naturforschende Gesellschaft von Juni, 1868, bis Juni, 1869. From the Society.
- Freiburg. Berichte über die Verhandlungen der Naturforschenden Gesellschaft. Band V, Heft II. 1869. From the Society.
- Göttingen. Nachrichten von der K. Gesellschaft der Wissenschaften und der Georg-Augusta Universität aus dem Jahre, 1869. From the Society.
- Astronomische Mittheilungen von K. Sternwarte zu Göttingen. Herausgegeben von der K. Gesellschaft der Wissenschaften zu Göttingen. 1er Theil. 1869. From the Society.
- Güstrow. Archiv des Vereins der Freunde der Naturgeschichte in Meklenburg. 23 Jahr. From the Society.
- Hannover. Achtzehnter und 19er Jahresbericht der Naturhistorischen Gesellschaft. 1869. From the Society.
- Königsberg. Schriften der K. Physikalisch-Ökonomischen Gesellschaft. 18er Jahrg., und 19er Jahrg., 1ste and 2e Abth., 1868. 20er Jahrg., 1 and 2 Abth. From the Society.
- Leipzig. Bericht über die Verhandlungen der K. Sachsischen Gesellschaft der Wissenschaften zu Leipzig. Mathematisch-Physische Classe, 1867, III, IV; 1868, I, III; 1869, I. From the Society.
- Abhandlungen of the same. IX, I, and II 1869. From the Society.
- Zeitschrift für Wissenschaftliche Zoologie. 19er Band, 4es Heft, to 20er Band, 3es Heft. Purchased.
- Jahrbücher für Wissenschaftlichen Botanik. 7er Band, 3es Heft. 1869. Purchased.
- Lüneburg. Jahresbericht des Naturwissenschaftlichen Vereins für das Fürstenthum Lüneburg. III und IV. From the Society.
- Mannheim. Funfunddreissigster Jahresbericht des Mannheimer Vereins für Naturkunde. 1869. From the Society.
- Marburg. Sitzungsberichte der Gesellschaft zur Beförderung der gesammten Naturwissenschaften in Marburg. Jahrg. 1866—1867—1868. From the Society.
- Schriften der Gesellschaft zur beförderung der gesammten Naturwissenschaften zu Marburg. Supplement Heft, III, IV, und V. From the Society.
- Munich. Annalen der K. Sternwarte bei München. XVII Band und IX Supplementband. 1869. From the Observatory.
- Vermischte Sammlungen der Sternwarte. VII. Supplementband.

- Abhandlungen of the same. Sechste Folge, 3er Band. From the Society.
- Regensburg. Correspondenz-Blatt des Zoologisch-Mineralogischen Vereines in Regensburg. 23er Jahrg. 1869. From the Society.
- Flora oder Allgemeine Botanische Zeitung herausgegeben von der K. B. Botanischen Gesellschaft. Neue Reihe, XXVII, Jahrg. 1869. From the Society.
- Stuttgart. Neues Jahrbuch für Mineralogie, Geologie und Palæontologie. Jahrgang, 1869, 6es Heft, to 1870, 5es Heft. From the Editor.
- Wien. Mittheilungen der Anthropologischen Gesellschaft in Wien. 1 Band, Probenummer, Nos. 2 and 3. From the Society.
- Sitzungsberichte der K. Akademie der Wissenschaften. Mathematisch-Naturwissenschaftlichen Classe. 58 Band, 1st Abth., to 60er Band, 1, 2 Abth., I and II Heft. From the Society.
- Denkschriften der K. Akademie der Wissenschaften. Math.-Naturw. Classe 29er Band. 1869. From the Society.
- Verhandlungen der K. K. Geologischen Reichsanstalt. No. 10, 1869, to No. 9, 1870. From the Bureau.
- Jahrbuch of the same. Jahrg., 1869, XIX Band, No. 3, to 1870, XX Band, No. 1. From the Bureau.
- Verhandlungen der K. K. Zoologisch-Botanischen Gesellschaft in Wien. Jahrg., 1869. XIX Band. From the Society.
- Schriften des Vereines zur Verbreitung Naturwissenschaftlichen Kenntnisse in Wien. Bands II—VIII. From the Society.
- Würzburg. Verzeichniss der Bibliothek der Physikalisch-Medicinischen Gesellschaft. 1869. From the Society.
- Verhandlungen of the same. Neue Folge, 1 Band, 4 Heft, 1869. From the Society.

## SWITZERLAND.

- Bern. Mittheilungen der Naturforschenden Gesellschaft aus dem Jahre. 1869. No. 684—711. 1870. From the Society.
- Geneva. Bibliothèque Universelle et Revue Suisse. Archives des Sciences Physiques et Naturelles. Nouvelle Periode. Tome 36me, No. 143, to Tome 38, No. 152. From the Editor.
- Lausanne. Bulletin de la Société Vaudoise des Sciences Naturelles. Vol. X, No. 62. 1869. From the Society.
- Neuchâtel. Bulletin de la Société des Sciences Naturelles de Neuchâtel. Tome VIII, 2me Cahier. 1869. From the Society.
- Solothurn. Verhandlungen der Schweizerischen Naturforschenden Gesellschaft. 53 Jahresversammlung. 1869. From the Society.
- St. Gallen. Bericht über die Thätigkeit der St. Gallischen Naturwissenschaftlichen Gesellschaft während des Vereinsjahres 1867—1868. From the Society.
- Zürich. Vierteljahresschrift der Naturforschenden Gesellschaft. 14er Jahrg., 1—4es Heft. 1869. From the Society.

## BELGIUM.

- Bruxelles. Annuaire de l'Académie Royale des Sciences, des Belles-Lettres et des Beaux-Arts de Belgique. 1870. 36me Année. From the Society.
- Bulletin of the same. 38me Année, 2me Ser. Tomes 27 and 28, 1869. From the Society.
- Mémoires Couronnés of the same. Col. in 8vo Tome XXI, Col. in 4to Tome XXXIV. From the Society.
- Leuven. Annuaire de l'Université Catholique. 1870. 34me Année. From the University.
- Mons. Mémoires et Publications de la Société des Sciences, des Arts et des Lettres du Hainaut. 1869—1870. From the Society.

## FRANCE.

- Angers. Mémoires de la Société Académique de Maine et Loire. Tomes XXI—XXIV. From the Society.
- Bordeaux. Société des Sciences Physiques et Naturelles de Bordeaux. Tomes V—VII. 1867—1869. Extrait des Procès-Verbaux des Séances, pp. 1—32. From the Society.
- Actes de l'Académie Impériale des Sciences, Belles-Lettres et Arts. 3e Série, 30e Année, 3me et 4me Trimestre, 1868. 31e Année, 1er Trimestre, 1869. From the Society.
- Actes de la Société Linnéenne de Bordeaux. Tome XXIV, 5e et 6e Livr. Tome XXVII, 1re Partie. 1870. From the Society.
- Lyon. Mémoires de l'Académie Impériale des Sciences, Belles-Lettres et Arts. Classe des Sciences. Tome 17me. 1869—1870. From the Society.
- Annales de la Société Linnéenne de Lyon. Année, 1869. Tome 17me. From the Society.
- Metz. Bulletin de la Société d'Histoire Naturelle du Département de la Moselle. 12me Cahier, 1870. From the Society.
- Orléans. Mémoires de la Société d'Agriculture, Sciences, Belles-Lettres et Arts d'Orléans. Seconde Série. Tome VIII, Nos. 1 et 2. 1870. From the Society.
- Cherbourg. Mémoires de la Société Impériale des Sciences Naturelles de Cherbourg. Tomes XIII et XIV. 1869. From the Society.
- Paris. Annales de la Société Entomologique de France. 4me Série. Tome 9me. 1869. From the Society.
- Annales des Sciences Naturelles. Botanique, Tome X, Nos. 3—6; Tomes XI, XII, et XIII; Tome XIV, No. 1. Purchased.
- Bulletin de la Société Botanique de France. Tome 16me. 1869. Comp. Rendu, 4—5. 1870. 1 Rev. Bibl. A—E. From the Society.
- Bulletin Mensuel de la Société Impériale Zoologique d'Acclimatation. 2me Série. Tome VII, Nos. 1—7. From the Society.
- Annales des Mines. 6me Série. Tome XVI, 5e et 6e Livr.; Tome XVII, Livr. 1—3. From the Minister of Public Works in France.
- Journal de Conchyliologie. 3e Série. Tome IX, No. 4; Tome X, Nos. 2 et 3. Paris. 1869. From the Editors.
- Nouvelles Archives du Museum d'Histoire Naturelle de Paris. 1869. 3me et 4me Fasc. Purchased.
- Nouvelles Météorologiques, publiées sous les auspices de la Société Mé-

- Genoa.** Effemeridi della Società di Letture e Conversazioni Scientifici. Anno 1, Fasc. 1. 1870. From the Society.
- Milan.** Memorie del R. Istituto Lombardo di Scienze e Lettere. Classe di Scienze, Matematiche e Naturali. Vol. X, Fasc. IV and V; Vol. XI, Fasc. I and II. From the Society.
- Reale Istituto Lombardo di Scienze e Lettere. Rendiconti. Classe di Scienze, Matematiche e Naturali. Vol. IV, Pts. II—X, Serie II; Vol. I and II, Nos. I—XVI. From the Society.
- Programma del R. Istituto Technico Superiore in Milano per l'anno Scolastico 1864—1869. From the Institute.
- Annuario del Reale Istituto Lombardo di Scienze e Lettere. 1868. From the Society.
- Palermo.** Giornale di Scienze Naturali et Economiche pubblicato per cura del Consiglio di Perfezionamento annesso al R. Istituto Technico di Palermo. Parte I Scienze Naturali. 1869. From the Society.
- Turin.** Atti della R. Accademia delle Scienze di Torino. Vol. IV, Disp. 1—7. 1869. From the Society.
- Sunti dei Lavori Scientifici Letti e Discussi di Scienze Morali, Storiche e Filologiche delle Reale Accademia delle Scienze di Torino dal 1859 al 1865. Torino. 1868. From the Society.
- Venice.** Atti del Reale Istituto Veneto di Scienze, Lettere ed Arti. Tomo 130, Disp. 1—10; Tomo 140, Disp. 1—6, 8 and 9. Venezia. 1867—1869. From the Society.
- Memoria del Regio Istituto Veneto. di Scienze, Lettere ed Arti. Vol. XIV, Part II. From the Society.

## GREAT BRITAIN AND IRELAND.

- Dublin.** The Journal of the Royal Dublin Society. Nos. 38 and 39. From the Society.
- The Transactions of the Royal Irish Academy. Vol. XXIV. Polite Literature, Part IV; Antiquities, Part VIII; Science, Parts IX to XV. 1867. From the Society.
- Edinburgh.** Transactions of the Royal Society. Vol. XXV, Part 11. From the Society.
- Proceedings of the same. Vol. VI, No. 77. From the Society.
- Transactions of the Edinburgh Geological Society. Vol. I, Part II. 1870. From the Society.
- Transactions and Proceedings of the Botanical Society. Vol. X, Part 1. 1869. From the Society.
- Leeds.** Philosophical and Literary Society. The Annual Report for 1869—70. From the Society.
- Report of the Proceedings of the Geological and Polytechnic Society of the West Riding of Yorkshire, 1869. From the Society.
- London.** The Annals and Magazine of Natural History. 4th Series. Vol. 3, No. 18, to Vol. 4, No 34. From the Library Fund.
- The Athenæum Journal, Nos. 2189 to 2235. From the Wilson Fund.
- The London, Edinburgh and Dublin Philosophical Magazine and Journal of Science. Vol. 37, 4th Series, No. 251 to Vol. 39, Nos. 261 and 263 to 267. 1869. Purchased.
- Proceedings of the Royal Institution of Great Britain. Vol. V, Parts 5, 6 and 7, Vol. VI, Parts 1 and 2. List of Members, etc. From the Society.
- The Food Journal, Nos. 1—10, Vol. 1. 1870. From the Editor.
- The Ibis. New Series. Vol. V, No. 20, to Vol. VI, No. 23. From the Wilson Fund.
- Notes and Queries. Part XVII, 4th Series, to XXXIII. From the Editor.
- The Journal of the Royal Asiatic Society of Great Britain and Ireland. New Series. Vol. IV, Part 2. 1870. From the Society.

*Journal of the Statistical Society of London.* Vol. XXXII, Part IV, Dec., 1869. From the Society.

*The Quarterly Journal of the Geological Society.* Vol. XXVI, Parts 1 and 2. From the Society.

*The Journal of Anatomy and Physiology.* 2d Series. Nos. 4, 5 and 6. Purchased.

*Nature.* Nos. 15, 22—25, 37, 40, 42—48 and 51. From the Editor.

*The Journal of the Chemical Society.* From July, 1869, to Oct., 1870. From the Society.

*Trübner's American and Oriental Literary Record.* Nos. 52—60. From the Publishers.

*The Student and Intellectual Observer.* No. 24, Jan., 1870, to No. 4, New Series. From the Editor.

*English Mechanic and Mirror of Science.* Vol. XI, Nos. 276—283. From the Editor.

Report of the thirty-ninth meeting of the British Association for the Advancement of Science. 1869. Purchased.

*Palæontological Society's Publications.* Vol. XXIII. Issued for 1869. From the Wilson Fund.

*The Journal of the Society of Arts and of the Institution in Union.* Vol. XXII, 1869. From the Society.

*Proceedings of the Royal Society.* Vol. XVII, No. 110, to Vol. XVIII, No. 118. From the Society.

*Philosophical Transactions of the same,* 1869. Vol. 159, Parts 1 and 2. From the Society.

*Proceedings of the Royal Geographical Society.* Vol. XIII, No. 1, to Vol. XIV, No. 1, 1868. From the Society.

*Journal of the same.* Vol. 39. From the Society.

*Proceedings of the Zoological Society.* 1865, Part III. 1867, Part I. 1869, Parts II and III. From the Society.

*Transactions of the same.* Vol. VII, Parts 1 and 2. From the Society.

*Proceedings of the Linnean Society.* Sessions 1868—69, 1869—70.

*Journal of the same.* Botany, Vol. X, No. 48; Vol. XI, Nos. 49—53, and Vol. XII. Zoology. Vol. X, Nos. 43—48, 1869.

*The Transactions of the Linnean Society.* Vol. XXV, Part 1, 1863. From Wm. S. Vaux.

*The same.* Vol. XXVI, Parts 2, 3 and 4, Vol. XXVII, Parts 1 and 2, 1868—69. From the Society.

New-Castle-upon-Tyne. *Natural History Transactions of Northumberland*

- Transactions of the Chicago Academy of Sciences. Vol. I, Part 2, 1869.  
 From the Society.  
 Indianapolis. The Indiana Journal of Medicine. Vol. I, No. 8. From the  
 Editor.  
 Louisville. The Journal of Science, Nov., 1870. From the Editor.  
 New Haven. The American Journal of Science and Arts. 2d Series. Vol.  
 49, Nos. 143—150, 1870. From the Editor.  
 New York. New York Medical Journal. Vol. X, No. 4, to Vol. XII, No. 4.  
 From the Editor.  
 The Medical Record. Nos. 92 and 93. From the Editor.  
 The Journal of Applied Science. No. 5, Vol. I, May, 1870. From the  
 Editor.  
 The Chemical News and Journal of Physical Sciences. Vol. VI, Nos. 2—6,  
 1870. From Messrs. Townsend & Adams.  
 The American Chemist. Vol. I, Nos. 2—6, 1870. From the Editor.  
 Annals of the Lyceum of Natural History of New York. Vol. IX, No.  
 7—10, 1869. From the Society.  
 Proceedings of the Lyceum of Natural History in the City of New York.  
 Vol. I, Pp. 1—44. From the Society.  
 First Annual Report of the American Museum of Natural History. From  
 the Trustees.  
 The American Gas-Light Journal. Vol. XII, No. 7, to Vol. XIII, No. 10.  
 From the Editor.  
 Bulletin of the Torrey Botanical Club. Nos. 1—10. From Thomas  
 Meehan.  
 Philadelphia. American Journal of Pharmacy. Vol. 42, Nos. 1—6. 3d  
 Series, Jan., 1870. From the Editor.  
 Proceedings of the American Pharmaceutical Association.  
 The Gardener's Monthly. Vol. XII, No. 2. From the Editor.  
 The American Journal of Medical Sciences, Nos. 117—120. New Series,  
 Jan., 1870. From the Editor.  
 The Medical News and Library. Vol. 28, Nos. 328—336. From the  
 Editor.  
 The Dental Cosmos. New Series. Vol. XII, Nos. 1—12, 1870. From  
 the Editors.  
 The Gardener's Monthly. Vol. XII, Nos. 1—12. From the Editor.  
 Proceedings of the Academy of Natural Sciences. No. 3, 1869, to No. 1,  
 1870. From the Publication Committee.  
 Scientific Journal. New Series. Vol. I, No. 1, to Vol. II, No. 3. From  
 the Editor.  
 Proceedings of the American Philosophical Society. Vol. XI, Nos. 82—84,  
 1870. From the Society.  
 Transactions of the same. Vol. XIV. New Series, Part 2, 1870. From  
 the Society.  
 The Penn Monthly Magazine. Nos. 4—12, 1870. From the Editor.  
 Salem. The American Naturalist. Vol. III, No. 11, to Vol. IV, No. 2. From  
 the Library Fund.  
 Bulletin of the Essex Institute. Vol. I, No. 5, to Vol. II, No. 8. From the  
 Society.  
 Essex Institute Historical Collections. Vol. X, Part 1, 1869. From the  
 Society.  
 Proceedings and Communications of the Essex Institute. Vol. VI, Part  
 1, 1868. From the Society.  
 San Francisco. The California Farmer for 1870. From the Editor.  
 Proceedings of the California Academy of Sciences. Vol. IV, Part 2,  
 1870. From the Society.  
 St. Louis. The American Entomologist and Botanist. Vol. II, Nos. 3—11,  
 1870. Purchased.

- Washington. Monthly Report of the Bureau of Statistics, Treasury Department. Nos. 2 to 11, 1869—70. From the Department.  
 Smithsonian Contributions to Knowledge. Vol. XVI. From the Institution.  
 Smithsonian Miscellaneous Collections. Vols. VIII and IX. From the Institution.  
 Annual Report of the Surgeon General, U. S. A., 1870. From the Author.  
 Worcester. Proceedings of the American Antiquarian Society. Oct. 21, 1869, April 27, 1870. From the Society.

## CANADA.

- Halifax. Proceedings and Transactions of the Nova Scotia Institute of Natural Science of Halifax, Nova Scotia. Vol. II, Part 3. From the Society.  
 Montreal. The Canadian Naturalist. New Series. Vol. IV, Nos. 3 and 4; Vol. V, No. 1, Sept., 1869. From the Editors.  
 Quebec. The Canadian Journal of Science, Literature and History. Vol. XII, Nos. 3, 6 and 10. From the Editors.  
 Transactions of the Literary and Historical Society. Sessions of 1869—70. New Series, Part 7. From the Society.  
 Toronto. The Canadian Entomologist. Vol. II, Nos. 4—9, 1870. From the Editor.

## SOUTH AMERICA.

- Buenos Aires. Anales del Museo publico de Buenos Aires. Entregas Sexta et Septima, 1860. From the Museum.  
 Santiago de Chile. Anales de la Universidad de Chile, 1867 and 1868. From the University.

## ASIA.

- Batavia. Natuurkundig Tijdschrift voor Nederlandsch Indie, uitgegeven door de K. Natuurkundige Vereeniging in Nederlandsch Indie. Deel 30, Zesde Serie. Deel V, Afd 3—6, 1868. From the Society.

## OTHER SCIENTIFIC WORKS.

- Jr., J. H. Redfield, Isaac Lea, Wm. S. Vaux, Thos. Meehan, E. Durand and Chas. Schaffer, M. D.
- Berre M. Alf. Preudhomme de. Description d'une nouvelle espèce Americaine du genre Caiman. From the Author.
- Notice sur des debris de Cheloniens faisant partie des Collections du Musée Royal d'Histoire Naturelle et provenant des Terrain Tertiaires des environs de Bruxelles. From the Author.
- Bradley, F. H. Geology of Vermilion County. From the Author.
- Brinton, D. G. Contributions to a Grammar of the Muskokee Language. 1870. From the Author.
- Bronn, Dr. H. G. Klassen und Ordnungen des Thier-Reichs. 5er Band, 11, 12 & 13 Lief. 6er Band, IV Abth. Leipzig, 1870. From the Wilson Fund.
- Byington, Rev. Cyrus. Grammar of the Choctaw Language. Edited by D. G. Brinton, M. D. From the Editor.
- Capellini, Prof. Cav. Giov. Ricordi di un Viaggio Scientifico nell' America Septentrionale nel 1863. Bologna, 1867. From the Author.
- Fossili Infraliassici dei Intorni del Golfo della Spezia. Bologna, 1866. From the Author.
- Les Phyllites Crétacées du Nebraska. From the Author.
- Giacimenti Petroleiferi di Vallachia e loro rapporti coi terreni terziari dell Italia Centrale. Bologna, 1868. From the Author.
- Catalogue of books added to the Library of Congress from Dec. 1, 1868, to Dec. 1, 1869. Washington. From the Librarian.
- Catalogue of the Maps of the British Possessions in India and other parts of Asia. London, 1870. From the Secretary of State for India.
- Catalogue of Scientific Papers, 1800—1863. Compiled and published by the Royal Society of London. Vol. III, 1869. From the Society.
- Conrad, T. A. Descriptions of new fossil shells of the Upper Amazon. From the Author.
- Cope, E. D. Second addition to the history of the Fishes of the Cretaceous of the U. S. From the Author.
- Fourth Contribution to the History of the Fauna of the Miocene and Eocene Periods of the United States. From the Author.
- On the Hypothesis of Evolution. From the Author.
- Cotteau et Triger Echinides du Département de la Sarthe. Paris, 1855—1869. From the Wilson Fund.
- Credner, Dr. H. Geognostische Aphorismen aus Nord-Amerika. Taf. I. From the Author.
- Die vorailurischen Gebilde der Oberen Halbinsel von Michigan in Nord-Amerika. From the Author.
- Dall, W. H. and H. M. Bannister. List of the Birds of Alaska, with Biographical Notes. From W. H. Dall.
- Dana, Jas. D. On the Geology of the New Haven Region. 1870. From the Author.
- Davidson, Geo. United States Coast Survey. Pacific Coast Pilot of Alaska (Part First). Coast Pilot of California, Oregon and Washington Territory. 2 vols. Washington, 1869. From the Coast Survey.
- Davidson, Hunter. Report upon the Oyster Resources of Maryland. Annapolis, 1870. From the Author.
- Decandolle, A. Prodromus Systematis Naturalis Regni Vegetabilis. Pars 16. Parisiis, 1869. From the Wilson Fund.
- Delfortrie, M. E. Description d'une machoire inférieure de Squalodon Grateloupi. From the Author.
- Des Moulins, M. Chas. Quelques réflexions sur la doctrine scientifique dite Darwinisme.
- Rapport a l'Académie de Bordeaux sur deux Memoires de MM. Linder et le Cte. Alexis de Chasteigner.
- Spécification et noms légitimes de six Échinolampes.

- Mueller, Dr. O. Walpers. *Annales Botanices Systematicæ*. Tomi Septima, Fasc. IV. Lipsiæ, 1869. From the Wilson Fund.
- Nelson, Dr. E. Thompson. *The Molluscan Fauna of the later tertiary of Peru*. From the Author.
- Newberry, J. S. *The Geological Survey of Ohio, its Progress in 1869*. From the Author.
- Nineteen quarto pamphlets of Norwegian Official Statistics. Christiania, 1869. From the Government.
- Packard, A. S. *Guide to the Study of Insects*. Salem, 1869. From Jos. Jeanes.
- Palæontological Society's Publications. Vol. XXIII. From the Wilson Fund.
- Palæontologie Française. Terrain Crétacé. Liv. 25. Terrain Jurassique. Livr. 19. From the Wilson Fund.
- Parry, C. C. *The Rocky Mountain Alpine Region*. From the Author.
- Pfeiffer, Dr. L. *Novitates Conchologicæ*. 1 Abth. Land Conchylien. 3er Lief. From the Wilson Fund.
- Photographs of *Carcharodon megalodon* tooth and vertebra. From Col. Jas. Greer.
- Pihl, O. A. L. *Micrometric Examination of Stellar Cluster in Perseus*. Christiania, 1869. From the Author.
- Prestel, Dr. M. A. F. *Das Gesetz der Winde abgeleitet aus dem Auftreten derselben über Nordwest Europa*. Emden, 1869. From the Author.
- Rapport sur la Maladie Nouvelle de la Vigne. Bordeaux, 1870. From the Linnean Soc. of Bordeaux.
- R. Comitato Geologico d'Italia. *Bollettino* Nos. 1—8. Anno, 1870. From the Survey.
- Records of the Geological Survey of India. Vol. 1, Parts 1, 2 and 3, 1868. Vol. 2, Part 1, 1869. From the Survey.
- Redfield, J. H. *Catalogue of the known Species, recent and fossil, of the Family Marginellidæ*. From the Author.
- Reeve, L. *Conchologia Iconica*. Parts 282, 283. From the Wilson Fund.
- Regnault, M. V. *Relation des expériences pour déterminer les lois et les données physiques nécessaires au calcul des machines à Feu*. Tome 3me. Paris, 1870. From the Author.
- Reports of the Commissioners of Fisheries of the State of Maine for the years 1867—1869. From Chas. G. Atkins.
- Report of the Secretary of the Treasurer on the State of the Finances for the year 1869. From the Treasury Department.
- Reichenbach, H. G. *Xenia Orchidaceæ*. 2er Band. 7es Heft., 1870. From the Wilson Fund.
- Revised rules of Zoological Nomenclature adopted by the British Association in 1865. From Prof. Marsh.
- Richard, M. *Oeuvres complètes de Buffon, suivies de la classification comparée de Cuvier, Lesson, &c*. Nouvelle édition. 5 Vols. Paris, 1837.

- Squier, E. G. *The Primeval Monuments of Peru compared with those in other parts of the World.* From the Author.
- Stainton, H. T. *The Natural History of Tineina.* Vols. X and XI. From the Wilson Fund.
- Stevens, E. T. *Flint Chips. A guide to Pre-Historic Archaeology.* London, 1870. From the Trustees of the Blackmore Museum.
- Supplement to the Catalogue of Books in the Mercantile Library of the City of New York, 1869.* From the Librarian.
- Sringar, W. F. R. *Algæ Japonicæ Musei Botanici Lugduno-Batavi.* Harlemi, 1870. From the Hollandische Academy.
- Syaneatvedt, A. S. D. *En Anatomisk Beskrivelse af de Paa over-og Underextremiteterne forekommende Bursæ Mucosæ, 1869.* From the Author.
- Toner, J. M. *Anniversary Oration delivered before the Medical Society of the District of Columbia, Sept. 26, 1866.* From the Author.
- Trutat et Cartailhac. *Materiaux pour l'Histoire primitive et naturelle de l'Homme. 5me Series. Nos. 9, 10, 11 and 12.* Purchased.
- Vacani, Barone C. *Della Laguna di Venezia.* Firenze, 1867. From the Author.
- Van Beneden, M. et Paul Gervais. *Osteographie des Cétacés vivants et fossiles. Texte and Atlas. Livrs. 6, 7 and 8.* Purchased.
- Villa, A. et Jo. Babt. *Coleopterorum diagnoses observationesque repetitæ in Catalogo dupletorum et supplementis extantes novis annotationibus aucta a fratribus A. et Jo. Babt. Villa. Mediolani, 1868.* From the Author.
- Von der Decken, Baron Carl Claus. *Reisen in Ost-Afrika. 3er Band, wissenschaftliche Ergebnisse. 1ste Abth, 1869.* Purchased.
- Wallace, A. R. *Contributions to the Theory of Natural Selection. A Series of Essays.* London, 1870. Purchased.
- Wallis, Severn Teackle. *Discourse on the Life and Character of George Peabody.* From the Author.
- Wechniakof, T. *Introduction aux recherches sur l'Economie des Travaux Scientifiques et Esthétiques, 1870.* From the Author.
- Wells, Walter. *The Water-Power of Maine.* Augusta, 1869. From the Author.
- Zittel, K. A. *Palaeontographica Supplement. Die Fauna der aeltern Cephalopoden Tuehrenden Tithonbildungen. 1ste, 2e Abth. and Atlas. Cassel, 1870.* From the Wilson Fund.

## INDEX TO GENERA.

---

|                            |          |                             |     |
|----------------------------|----------|-----------------------------|-----|
| <b>Abaster</b> .....       | 121      | <b>Carbonarea</b> .....     | 39  |
| <b>Abies</b> .....         | 91       | <b>Carinifex</b> .....      | 59  |
| <b>Acacia</b> .....        | 137      | <b>Centrophilus</b> .....   | 77  |
| <b>Acridium</b> .....      | 78       | <b>Centromochlus</b> .....  | 95  |
| <b>Aelurodon</b> .....     | 66       | <b>Centropristis</b> .....  | 120 |
| <b>Agriochærus</b> .....   | 67, 112  | <b>Cephalobus</b> .....     | 89  |
| <b>Ampelopsis</b> .....    | 103, 136 | <b>Ceratophyllum</b> .....  | 90  |
| <b>Anabrus</b> .....       | 74       | <b>Cetopsis</b> .....       | 95  |
| <b>Anomodon</b> .....      | 13       | <b>Chætetes</b> .....       | 35  |
| <b>Anchitherium</b> .....  | 109, 112 | <b>Chalicotherium</b> ..... | 113 |
| <b>Anoylus</b> .....       | 57       | <b>Chelydra</b> .....       | 123 |
| <b>Anemone</b> .....       | 116      | <b>Chenolopez</b> .....     | 130 |
| <b>Anguillula</b> .....    | 69       | <b>Chionocetes</b> .....    | 106 |
| <b>Anser</b> .....         | 130      | <b>Chlætropus</b> .....     | 131 |
| <b>Apogon</b> .....        | 119      | <b>Chæphaga</b> .....       | 131 |
| <b>Aquila</b> .....        | 141      | <b>Chonetes</b> .....       | 35  |
| <b>Aralia</b> .....        | 107      | <b>Cimoliasaurus</b> .....  | 21  |
| <b>Archibuteo</b> .....    | 141      | <b>Clematis</b> .....       | 135 |
| <b>Ardea</b> .....         | 88       | <b>Clidaates</b> .....      | 3   |
| <b>Asaphus</b> .....       | 53       | <b>Clinopistha</b> .....    | 43  |
| <b>Asteracanthus</b> ..... | 13       | <b>Codonites</b> .....      | 31  |

|                    |                 |                    |              |
|--------------------|-----------------|--------------------|--------------|
| Edestus.....       | 13              | Liriodendron.....  | 116          |
| Elanns.....        | 144             | Liturites.....     | 51           |
| Elaps.....         | 121             | Lonicera.....      | 102          |
| Elasmosaurus.....  | 9, 18, 132      | Lophiodon.....     | 109          |
| Eleocharis.....    | 137             | Lophiotherium..... | 126          |
| Elotherium.....    | 3               |                    |              |
| Elephas.....       | 69, 96          | Maclura.....       | 132          |
| Emys.....          | 5, 123          | Macrodon.....      | 40           |
| Encrinus.....      | 18              | Macrosaurus.....   | 2, 4         |
| Ephippitytha.....  | 76              | Magnolia.....      | 114          |
| Equus.....         | 67, 69, 98, 127 | Manayunkia.....    | 100, 102     |
| Euomphalus.....    | 61              | Mastodon.....      | 67, 96       |
| Eupachycrinus..... | 30              | Megalaima.....     | 88           |
| Euphorbia.....     | 14, 118         | Megalomeryx.....   | 2            |
|                    |                 | Megalonyx.....     | 13           |
| Fabricia.....      | 101             | Megalosaurus.....  | 3            |
| Falco.....         | 139, 145        | Melania.....       | 58           |
| Fenestella.....    | 16              | Meleagris.....     | 11           |
| Fragaria.....      | 71              | Melicerta.....     | 72           |
|                    |                 | Merops.....        | 88           |
| Glareola.....      | 85              | Merychippus.....   | 67           |
| Glyphidodon.....   | 119             | Merycochærus.....  | 109, 111     |
| Gobiesox.....      | 121             | Merycodus.....     | 109          |
| Graphiodon.....    | 122             | Merychys.....      | 109          |
| Grus.....          | 6               | Microsus.....      | 113          |
| Grystes.....       | 110             | Modiolopsis.....   | 41           |
| Gymnocladus.....   | 102             | Monotis.....       | 38           |
|                    |                 | Morus.....         | 137          |
| Hadrosaurus.....   | 2, 67           | Mosasaurus.....    | 2, 132       |
| Halæetus.....      | 143             | Mylocyprinus.....  | 70           |
| Halisaurus.....    | 3               | Mylodon.....       | 8            |
| Hedera.....        | 108             |                    |              |
| Hemirhamphus.....  | 119, 121        | Nauclerus.....     | 144          |
| Hipparion.....     | 109             | Nautilus.....      | 47           |
| Hippidion.....     | 127             | Nephelis.....      | 89           |
| Hirudo.....        | 89              | Notharctus.....    | 114          |
| Hottenia.....      | 127             | Nothosaurops.....  | 74           |
| Homocrinus.....    | 30              | Nothosaurus.....   | 74           |
| Hoopesia.....      | 137             | Nyctale.....       | 73           |
| Huenia.....        | 107             |                    |              |
| Hydra.....         | 72, 100         | Oedipoda.....      | 79           |
| Hydrolycus.....    | 93              | Olenus.....        | 64           |
| Hyopotamus.....    | 113             | Oligoporus.....    | 34           |
| Hyporthodus.....   | 119             | Oncobatis.....     | 70           |
| Hypotriorchis..... | 146             | Onychotes.....     | 142, 149     |
| Hyracodon.....     | 65              | Ophibolus.....     | 90           |
|                    |                 | Opomola.....       | 77           |
| Ictinia.....       | 144             | Orchelimum.....    | 77           |
| Illænus.....       | 54              | Oreodon.....       | 67, 109, 111 |
|                    |                 | Oressochen.....    | 131          |
| Juncus.....        | 137             | Ortygometra.....   | 86           |
|                    |                 | Ovibos.....        | 73           |
| Laormis.....       | 5               | Oxyrrhopus.....    | 90           |
| Leiodon.....       | 2, 4            |                    |              |
| Lemna.....         | 90              | Palæosyops.....    | 113          |
| Leptomeryx.....    | 112             | Palæotringa.....   | 5            |
| Libinia.....       | 104             | Palæotherium.....  | 113          |
| Limnias.....       | 72, 100         | Paludicella.....   | 100          |
| Liodon.....        | 132             | Palamedea.....     | 87           |

|                      |          |                       |        |
|----------------------|----------|-----------------------|--------|
| Pandion.....         | 143      | Selene.....           | 119    |
| Paradoxides.....     | 62       | Septopora.....        | 15     |
| Patriofelia.....     | 11       | Silphium.....         | 117    |
| Pectinatella.....    | 90       | Sivatherium.....      | 1      |
| Pedicellina.....     | 101      | Solanum.....          | 103    |
| Pentremites.....     | 31       | Solenochilus.....     | 47     |
| Petunia.....         | 90       | Sorubimichthys.....   | 94     |
| Pezotettix.....      | 78       | Sparganium.....       | 69     |
| Pheronema.....       | 127      | Sph. rium.....        | 56     |
| Philacte.....        | 131      | Spirifer.....         | 36, 60 |
| Phillipsia.....      | 52       | Spongilla.....        | 100    |
| Phytolacca.....      | 102      | Staphylea.....        | 115    |
| Pinus.....           | 72       | Stauronotus.....      | 82     |
| Platycarpus.....     | 132      | Staurotypus.....      | 4      |
| Platygonus.....      | 13       | Stentor.....          | 90     |
| Plesiosaurus.....    | 9, 19    | Straparollus.....     | 45     |
| Pleurophorus.....    | 18       | Stricklandinia.....   | 37     |
| Plumatella.....      | 100      | Styliemys.....        | 67     |
| Poecilopleuron.....  | 3        | Subulites.....        | 47     |
| Polyborus.....       | 145      | Syncladia.....        | 15     |
| Polycotylus.....     | 132      |                       |        |
| Polypora.....        | 16       | Tænidestes.....       | 132    |
| Poteriocrinites..... | 26       | Telmatornis.....      | 6      |
| Priacanthus.....     | 119, 121 | Temnochilus.....      | 49     |
| Priotelus.....       | 88       | Tetragonopterina..... | 92     |
| Procellaria.....     | 85       | Tetraodon.....        | 120    |
| Procyon.....         | 13       | Thalassidroma.....    | 85     |
| Promicropterys.....  | 119      | Thamnotrizon.....     | 76     |
| Protohippus.....     | 67, 127  | Thespesius.....       | 67     |
| Ptilopogon.....      | 88       | Tinnunculus.....      | 148    |
| Pterocles.....       | 86       | Titanotherium.....    | 2, 113 |
| Ptychodus.....       | 12       | Tomonotus.....        | 82     |
| Puffinus.....        | 6        | Trionyx.....          | 5      |
| Pygocentrus.....     | 93       | Trogon.....           | 88     |
|                      |          | Triticum.....         | 125    |
| Raboldes.....        | 92       | Trachodon.....        | 67     |
| Racetraculites.....  | 22       | Traxinus.....         | 115    |
| Reductus.....        | 110      | Tricentothalpus.....  | 30     |

## GENERAL INDEX.

---

Amendment of the By-laws, 14.

Bannister, A sketch of the classification of the American Anserinæ, 130.

Buckley, S. B., Remarks on Dr. Asa Gray's notes on Buckley's rare Plants of Texas, 133, 135.

Coombs, Gilbert, Resignation as member, 71.

Cope, E. D., Remarks on a specimen of *Trigonocephalus*, 90; Observations on some Fishes new to the American Fauna, found at Newport, R. I., 118; Remarks on fossil reptiles from the cretaceous of Kansas, 132.

Correspondence, 159.

Donations to Library, 162.

Elections during 1870, 158.

Gill, Theo., On some new species of Fishes obtained by Prof. Orton from the Marañon River, Upper Amazon and Napo Rivers, 91, 92.

Hallowell, Caleb S., Announcement of death of, 8.

Leeds, Prof., Exhibition of crystalline Staffelite, 122; On an interesting geological phenomenon, 134.

Leidy, Jos., Remarks on *Megacerops Coloradensis*, 1; Remarks on *Poicilopleuron valens* and other fossils, 3; On the humerus of a sloth resembling *Myodon robustus* and on *Dromotherium silvestre*, 8; On reptilian remains from the cretaceous formation near Fort Wallace, Kansas, 9; On specimens of vertebral bodies from the New Jersey green sand, 10; On a fossil mandible from near Fort Bridger, Wyoming, 10; On *Ichthyodorulites*, 12; On fossil remains from Illinois, 13; On *Dicosauros* and its Allies, 18; On the internal organs of generation of a

Hog, 65; On fossil bones from Dakota and Nebraska, 65; On fossil remains from Idaho, Utah and Oregon, 67; On *Hadrosaurus* and its Allies, 67; On *Anguillulidæ*, 68; On fossils from the vicinity of Burlington, Kansas, and from the Rocky Mts., 69; On the relations of European and American Fauna, 72; On a jaw fragment of *Ovibos cavirostris*, 73; On *Nothosaurops occidentalis*, 74; On Leeches, 89; On *Mastodon* remains, 96; On fossil remains in the Museum of Amherst College, 98; On *Crocodylus Elliotti*, 100; On ciliated Polyps, 100; On fossils from Sweet Water River, Wyoming Ter., 109; On fossils from Bridge Creek, Oregon, 111; On *Cordylophora*, 113; On fossils from Church Buttes, Wyoming Ter., 113; On *Graphiodon vinearius*, 122; On fossil remains of reptiles, 122, 123; On fossils found under Table Mountain, Cal., 125; Exhibition of the lower jaw of an aged man, and a wood carving from St. Paul de Loando, 133; On the reversed viscera of a human subject, 134.

Marsh, Prof. O. C., Remarks on fossil vertebræ from the cretaceous green sand near Barnesboro, N. J., 2; On fossil birds from the cretaceous and tertiary of the United States, 5; On *Meleagris altus*, 11; On *Dicotyles antiquus*, 11.

Meek, F. B., Description of fossils collected during the U. S. Geological Survey under the charge of Clarence King, 12, 56.

Meek, F. B. and A. H. Worthen, Note on the relations of *Syncladia*, King (1849) to the proposed genus of *Septopora*, Prout (1858), 8, 15; Description of new species and genera of fossils from the Palæozoic rocks of the Western States, 8, 22.

Meehan, T., Cross fertilization and law of sex in *Euphorbia*, 11, 14;

On the formation of bark and wood, 13; On the Stipules of Magnolia and Liriodendron, 71, 114; On Rumex oblongifolius, 71; On Fertilization of plants, 90; On Fasciations, 91; On the flowers of Aralia spinosa and Hedera helix, 99, 107; On Phyllotaxis, 102; On a singular habit in Reduvius novenarius, Say, 110; Notes on Silphium lancinatum, L. 117; On the exercise of direct force by plants, 125; Bud Varieties, 128; On Maclura aurantiaca, 132.

Norris, Thaddeus, Remarks on fish culture, 110.

Officers for 1871, 157.

Rand, Theo, D., On a remarkable exposure of rocks, 134.

Redfield, Remarks on Botrychium lunarioides and B. lanceolatum, 91.

Ridgway, Robt., A new classification of the North American Falconidæ, 134, 138.

Report of the Librarian, 150.

Report of the Curators, 151.

Report of the Botanical Committee, 152.

Report of Recording Secretary, 153.

Report of Biological Section, 153.

Reports of the Conchological Section, 154.

Standing Committees for 1870.

Streets, T. Hale, Remarks on Huxley's classification of Birds, 71, 84; On the cranium of an Owl, 73; Notice of some Crustaceans of the genus Libinia with descriptions of three new species, 96, 104.

Thomas, Cyrus, Description of new species of Grasshoppers from Colorado, 66, 74.

Wharton, Jos., Remarks on Nickel ore at Gap, Lancaster Co., Pa.

Willard, Prof., Remarks on a deposit of Clay, 122.

Wilstach, Wm. P., Announcement of death of, and resolutions in regard to, 163.

## ERRATA.

Page 25, fourteenth line from bottom, for "subrachial," read *subbrachial*.

" 31, fifteenth line from bottom, for "basas," read *basal*; and sixteenth line from bottom for "lansal" read *basal*.

**BIOLOGICAL AND MICROSCOPICAL DEPARTMENT**  
**OF THE**  
**ACADEMY OF NATURAL SCIENCES.**

---

*Jan. 3d, 1870.*

**Director S. W. MITCHELL, M.D., in the Chair.**

**Eighteen members present.**

Dr. McQUILLEN exhibited the skull of a hedge-hog, in which, owing to fracture of the left lower incisor, the superior incisor of that side, failing to meet with its antagonist, had formed a complete circle, the apex of the tooth penetrating the right upper maxilla just in front of the molars. The right upper incisor also had been fractured, and the inferior incisor of that side had grown to more than twice the usual length, and assumed the form of a tusk. The skull of a squirrel was also shown, in which, owing to a similar accident, the superior incisors had formed a complete circle and penetrated the upper maxilla.

---

*Jan. 17th.*

**Director S. W. MITCHELL, M.D., in the Chair.**

**Fourteen members present.**

Dr. McQUILLEN exhibited the pulp of a lower molar, with the vessels naturally injected. The principal points of interest connected with the specimen were the dentinal fibrili, which were quite evident under the microscope, projecting from a fragment of dentine. In commenting on the specimen, the speaker stated that these fibrili, which are located in the dentinal tubuli, were first observed some eight or ten years ago in the human teeth by John Tomes, F.R.S., of London, who regards them as the continuation of the nerves of the dental pulp, and accounts for the exquisite sensibility of the dentine in excavating decay from the cavity of a tooth, by impressions made upon these filaments. The speaker would not pretend to assert that this was an untenable position, but he inclined to the opinion that the dentinal fibrili are to be regarded as post mortem results occurring after the extraction of a tooth, and due to the coagulation of the fibrine of the liquor sanguinis circulating in the dentinal tubuli during life. In the removal of pulps from the teeth when devitalized by arsenical application, or breaking up a tooth after extraction, he had found no difficulty in separating the pulp from the dentine, which would hardly be possible if the nerve fibres passed into the millions of tubuli in the dentine, or under such circumstances an attachment would be formed exceedingly difficult of separation.

A large plaster model of an incisor tooth, with a vertical section showing the arrangement of the enamel, cementum, dentine, pulp cavity and pulp, was used in illustration of the remarks.

*Feb. 7th.*

Vice-Director W. PEPPER, M.D., in the Chair.

Fourteen members present.

MR. W. H. WALMSLEY exhibited mounted sections of a testicle removed from a so-called hermaphrodite, who otherwise presented the external configuration of a woman, and who was looked upon in society as a female. The testicle exhibited tubular structure, and was removed at the patient's request.

MR. T. W. STARR exhibited a slide showing malformation in a spider, which had eight legs and nine feet.

---

*Feb. 24th.*

Director S. W. MITCHELL, M.D., in the Chair.

Eleven members present.

---

*March 7th.*

Vice-Director W. PEPPER, M.D., in the Chair.

Six members present.

DR. McQUILLEN stated that during certain experiments with the hydrate of chloral, he had reason to doubt the correctness of the view of Leibrecht and B. W. Richardson, that it was decomposed in the blood and converted into chloroform.

---

*March 21st.*

Director S. W. MITCHELL, M.D., in the Chair.

Thirteen members present.

Dr. T. W. Starr exhibited a (slide on (Microscopic) Microscopic) Dr.



April 4th.

Director S. W. MITCHELL, M.D., in the Chair.

Eleven members present.

The Corresponding Secretary reported the presentation of a copy of Lieut.-Col. J. J. Woodward's Report on the Magnesium and Electric Lights as applied to Photo-Micrography; illustrated by a number of large photographs.

DR. S. W. MITCHELL exhibited a slide showing the ova of *Bilharzia hæmatobia*, believed to cause the intermittent Hæmaturia of the Cape of Good Hope and Natal, the specimen having been forwarded to him by his friend Dr. Harley, of London; and made some remarks upon the parasite.

Dr. James Tyson resigned the position of Recorder, and Dr. J. G. Richardson was elected to the vacancy.

---

April 18th.

J. GIBBONS HUNT, M.D., in the Chair.

Eighteen members present.

DR. WM. F. NORRIS made a verbal communication in regard to the use of weak solution of nitrate of silver and chloride of gold in the preparation of tissues for microscopic examination, which he illustrated by numerous mounted specimens, &c.

DR. HUNT inquired what strength of the solution of the nitrate of silver was employed.

DR. NORRIS replied that his ordinary solution was one-half of one per cent., and in answer to a question from Dr. Truman, stated that the chloride of gold liquid was of the same strength. Several members having mentioned that they met with nothing but failures in attempting to employ these processes, Dr. Norris remarked that he was at a loss to account for this want of success, and believed that if the half per cent. solutions were used in a dark room, and the specimens allowed to soak in glycerine slightly acidulated with acetic acid, afterwards exposing them to the light until sufficiently colored, no difficulty would be experienced.

DR. J. G. HUNT exhibited some mounted slides of *Saxafraga sarmentosa*, and observed that in regard to the stomata in plants the general rule is that they are distributed all over the under surface of the leaves. We find exceptions to this law, however, in some species of *Saxafraga*, and in *S. sarmentosa* the stomata are grouped in clusters only, and are not found in the cells between the clusters. In other species of the genus the same peculiarity occurs, but this arrangement of the stomata cannot be regarded as a generic feature, because some of the *Saxafrages* have these organs distributed all over the under surfaces of their leaves.

Dr. Hunt further remarked that the singular amœboid movement so often noticed in the white blood corpuscle seems to be a phenomenon not confined to the animal kingdom. A movement apparently similar may be distinctly observed in the nucleus of the cell of *Anacharis alsinastrium*, and in the plant the movement appears to be more active than that seen in the blood.

PROCEEDINGS OF THE

*May 2d.*

Director S. W. MITCHELL, M.D., in the Chair.

Thirteen members present.

---

*May 16th.*

Director S. W. MITCHELL, M.D., in the Chair.

Eighteen members present.

Dr. J. GIBBONS HUNT exhibited a species of the frondose Hepaticæ,—the *Grimaldia barbifrons*. Its sporangia are borne on the ends of pedicels, and they contain spores and elaters of great beauty. The stomata in the heads of a plant open into chimney-like canals built up of cells, and these canals dip down into the tissues of the plant. This family of cryptogams offers to the microscopist many objects of beauty, as well as of physiological interest, when properly studied.

---

*June 6th.*

Director S. W. MITCHELL, M.D., in the Chair.

Sixteen members present.

PROF. J. H. MCQUILLEN, Corresponding Secretary, read a communication from the American Microscopical Society of New York City, requesting an interchange of specimens, and of published transactions as far as possible.

---

*June 21st.*

Director S. W. MITCHELL, M.D., in the Chair.

Ten members present.

A letter was read by the Secretary from Prof. Joseph Henry, of the Smithsonian Institution, Washington, submitting a specimen of



3d. That the Janitor be requested to place the microscopes of the Section on the table at every meeting.

4th. That arrangements be made with the new Medical Journal to publish a synopsis of the proceedings, and, if possible, to announce the subject for discussion before the meetings.

The following paper was ordered to be published :

**Is Atropia an antidote to Hydrocyanic Acid ?**

BY DR. W. W. KEEN.

Having been recently called upon, as a member of a committee of the Pathological Society, to investigate the blood of Geo. S. Twitchell, Jr., the murderer (who poisoned himself by prussic acid), my attention was called to the lately asserted antidotal powers of atropia, and I made a number of experiments on the subject, the result of which I now report to the Department.

In the Glasgow Med. Jour., Nov., 1868, p. 70 et seq., will be found an extended analysis of Preyer's recent work on prussic acid (Die Blausäure, Bonn, 1868), which I must quote as authority, as I had not access to the original work. The questions as to action of the poison on the spectrum analysis of the blood, on its coagulation, on the heart, &c., are foreign to my present purpose, and will be found discussed both in the paper just alluded to and in our report to the Pathological Society. (Amer. Jour. Med. Sci. vol. 58, p. 432.)

Preyer's conclusions, from numerous experiments, are that HCy kills by suffocation induced by three means :

1<sup>o</sup>, it stimulates or tetanizes the pulmonary branches of the vagus, so that the respiration ceases.

2<sup>o</sup>, it stimulates or tetanizes the cardiac branches of the vagus (and also the sympathetic ganglia of the heart in some cases), and thus arrests the circulation.

3<sup>o</sup>, it acts on the respiratory nervous centre, so that the breathing on being re-established is retarded more and more, till death follows.

Atropia, he states, has precisely an antagonistic action, and therefore should be and is an antidote. That atropia does have such an action as he has asserted on the circulation, is the conclusion to which Drs. Mitchell, Morhouse and myself came in studying the antagonism of opium and belladonna, and published in the Amer. Jour. Med. Sci., July, 1865; but that it affects the respiration is contrary to our experiments at that time, and that it acts as an antidote to prussic acid my present experiments, so far as they go, certainly disprove.

Preyer states that if the 0.015 of a grain—i. e., one millegramme—of sulphate of atropia be injected under the skin of a rabbit, a lethal dose of HCy may be given without producing death; or if the HCy be first administered, that then the atropia will arrest its poisonous action if it is given quickly enough.

Exp. I. May 12, 1869. Injected 0.017 gr. of sulph. atropia under the skin of the back of a rabbit, followed in half a minute by 3 M of officinal dilute hydrocyanic acid.

In 1½ minutes after the last injection he fell over convulsed; opisthotonos.

In 2½ minutes pupils began to contract.

In 5½ minutes respiration had ceased; heart still beating.

In 6½ minutes, dead.

On the post mortem examination, made immediately, the heart was found to present the slight rythmicall twitching usually noticed in the right auricle after poisoning by HCy, but here observed in the walls of all the cavities save the right ventricle.

Exp. II. Injected as before under the skin of a rabbit gr. 0.010 atrop. sulph., followed in half a minute by 2 M HCy.

In 2½ minutes respiration arrested.

In  $3\frac{1}{2}$  minutes re-established, 16 in the minute; spasms; cry; heart beating.  
 In  $4\frac{1}{2}$  minutes, respiration ceased.  
 In  $5\frac{1}{2}$  minutes, pupils contracting.  
 In  $7\frac{1}{2}$  minutes, heart ceased; dead.  
 Heart twitching as in Exp. I.

*Exp. III.* Injected as before 0.015 gr. atrop. sulph., followed in half a minute by 2 minims HCy.

In  $\frac{1}{2}$  minute, respiration rapid.  
 In 1 minute, pupil contracting.  
 In  $1\frac{1}{2}$  minute, opisthotonos very severe.  
 In 2 minutes, respiration 32, and labored.  
 In 3 minutes, respiration stopped.  
 In 5 minutes, dead.

*Exp. IV.* Injected the HCy first, 3 minims.

In  $1\frac{1}{2}$  minutes fell over in convulsions.  
 In 2 minutes gave 0.015 gr. atrop. sulph.  
 In  $2\frac{1}{2}$  minutes, gasping very slowly.  
 In  $3\frac{1}{2}$  minutes, dead.

Besides these, I also performed four other experiments, in which larger doses were used with the like result, as follows:

*Exp. V.* Injected gr. 0.2 atrop. sulph., followed in half a minute by 10 minims HCy. Death in  $4\frac{1}{2}$  minutes.

*Exp. VI.* Injected gr. 0.2 atrop. sulph., and in half a minute 5 minims HCy. Death in 4 minutes.

*Exp. VII.* Injected gr. 0.1 atrop. sulph., followed in half a minute by 2 minims HCy. Death in  $6\frac{1}{2}$  minutes.

*Exp. VIII.* Injected 0.063 gr. atrop. sulph., followed in half a minute by 1 minim HCy. Death in 10 minutes.

That the rabbits did not die as the result of atropia poisoning, I take for granted, inasmuch as very many experiments on all sides prove them to be unaffected by belladonna in any form, as much as 2 grains of atropia not having produced death. Their peculiar insusceptibility to atropia therefore eliminates a difficulty often felt in similar experiments,—viz., to test which of the poisons killed. It may be objected, then, that as atropia does not act on the rabbit, it cannot be expected to act as an antidote here. Preyer, however, asserts that it does act as an antidote in the case of rabbits and of other

ing laborious; opisthotonos. 2.48. General convulsions. 2.50. Breathing rapid and laborious. 3.40. Died.

That the dogs did not die from the atropia is evident, especially by reference to Dr. Harley's experiments (On the old Vegetable Neurotics, pp. 198—202), where as much as one-fourth of a grain was given without producing more than slight poisonous action.

I do not regard my experiments as sufficiently extended to be conclusive, but as disproving a positive assertion they are of a certain importance.

On favorable report of the Committee, the following paper was ordered to be published:

### Case of Hypospadias—Male Hermaphroditism.

By Prof. CHRISTOPHER JOHNSTON, M.D., Baltimore.

"It is with Hermaphrodisms," says Isidore Geof. St. Hilaire, "as with all other anomalies: as we approach them the marvellous disappears; but their scientific interest increases, and all particular facts, bound together by theory, explained by simple considerations, present themselves to the observer as the diverse but concordant consequences of a small number of principles which govern the whole domain of teratology.

"Thus it is, whether we examine the reproductive apparatus of a male hermaphrodite, or consider the totality of his physical constitution, or study him in a moral point of view, we reach the same conclusion, namely, an analogy more or less apparent with the conditions of femininity, but at bottom an essentially masculine organization as well as tastes and proclivities."

These reflections serve very appropriately to introduce the short history of a case of so-called male hermaphroditism, in which, at the age of nineteen years, the subject of it, having been previously looked upon as a girl, was suddenly transformed into a boy by the decision of experts.

The case is as follows: X. Y., aged nineteen years, is of medium height, fair complexion, blue eyes, brown hair, face feminine, voice puerile and beard sprouting rather thickly for his age and slight figure. His general appearance indicates health. It may be added that his gait and deportment are decidedly girlish, for he drops his garments when stripping for examination; and he assures us that he assumed the position of the *Venus accroupie* when, as in Father Tom's case, "*vesica sua simul erat rumpere*."

He gives of himself the history we reproduce, and which is corroborated by his mother and brother.

At birth he was looked upon as a girl normally developed, wherefore the age of seven years saw him still in frocks. At this period of his life he was struck by a piece of falling timber upon the abdomen, and, his body undergoing investigation in consequence, a peculiarity in the conformation of his outer genital parts was observed, but its nature was not ascertained nor, of course, understood. As he was but slightly injured no connection was alleged between the accident and the abnormal development; and as no importance was attached to his "peculiarity," he was recommitted to frocks and the matter forgotten. He continued to be regarded as a girl, wore the attire of a female, and associated very intimately with girls of the period. As a child he had a remarkably fine voice, a boy's soprano, and was accustomed to sing at public concerts; but at the age of fourteen his voice suddenly changed in quality, became piping, and lost much of its original compass.

A few months ago—as he tells us—his beard began to grow, and this circumstance occasioned him great annoyance, by reason of the remark it excited. Failing in his attempts to suppress the growth of hair upon his face, and stung by the ill-natured remarks its presence evoked, he lopped off his long braids, assumed the habiliments of a man, and fled from his maternal roof. It would also appear that this conclusion was assisted by the opinion of a medical

gentleman, to whom, suspecting his proper sex, he had had recourse in order to satisfy his doubts as to his sexual status.

Far from his home, chance now led him to our door, and upon his request we made a satisfactory examination.

His framework is that of a male. The mammae are undeveloped, the thorax and limbs quite hairy, and the pubis and genitals unusually hirsute. A median fissure separated two apparent labia, and, as hair conceals all else, the impression is decidedly womanly; nor is that impression altogether effaced by drawing apart the labia, for the cleft extends deeply, seems to merge into a small vagina, above which a *mentus urinaris* lies under the arch of the pubis. But higher up a penis appears, one inch and three quarters in length, by three-fourths in diameter, surrounded by an imperforate glans uncovered by prepuce. A groove extends along the under surface of the penis, and runs back to within one inch of the anus, being about three inches in length. This groove, lined by mucous membrane, is the roof of the urethra, which deepens posteriorly, and is finally concealed by overhanging scrotal pouches. Traction upon these shows its termination in a deeply imbedded meatus, which lies about half an inch anteriorly to a blind fossa about the size of a crow quill in capacity and half an inch in depth. The meatus and cul de sac are comprised in an oval space about an inch in length, bounded laterally by an elevated ridge of mucous membrane, and posteriorly limited by a fourchette.

The prepuce, dividing on the under surface of the penis, is continuous with bands of mucous membrane, which simulate the labia minora of the female, and are lost upon the inner sides of the scrota. The proximate surfaces of the scrotal pouches have the character of mucous membrane, are red, vascular and moist, and are traceable into the urethra and vaginoid cul de sac.

A careful examination with the finger in the rectum and a catheter in the bladder, recognizes no trace of uterus, and the blind fossa which simulates a rudimentary vagina appears to be independent of all other parts but the mucous membrane which forms its walls. The indications of the existence of a prostate are uncertain.

A small oval glandular body occupies each inguinal canal, has the form of a testicle, but is softer to the touch. These bodies, lying just within the external abdominal ring, are the testicles, which have not descended beyond that opening.

The sexual feeling is as feebly developed as the external parts of generation. It is somewhat doubtful if that feeling exists at all as the statements

October 3d, 1870.

Director S. W. MITCHELL, M. D., in the Chair.

Thirteen members present.

The report of the Committee upon the *Myiarchus cinerascens* was presented, as follows :

The Committee to which was referred the specimen of *Myiarchus cinerascens* vel *Mexicanus*, with 'fungous growth of its feet,' forwarded for investigation from the Smithsonian Institution of Washington, report that, although the great changes which have taken place in the abnormal formation by drying render it impossible to determine with certainty its nature during the life of the bird, they have been able to recognize the following characteristics: Examined with a hand magnifying glass, the adventitious structure was found to be porous, and to present a cellular appearance closely resembling that of a section of mammalian lung which had been inflated and dried. A thin slice immersed in liquor potassa or glycerin and examined with a power of 200 diameters, was seen to be composed of bands of material resembling fibrous tissue, arranged so as to form alveoli, each about 1-150th of an inch in diameter with a wall of 1-600th of an inch in thickness. These alveoli frequently contained mycelial threads, apparently of some fungus of the *Leptothrix* type, and occasionally portions of *Acari*, resembling the *A. Scabiei*, with their ova and excrement. It seemed improbable that this pathological product was the result of the integument covering the legs and feet, and bearing even a fanciful analogy to the *Elephantiasis* of human beings; first, because a transverse section of one of the toes showed the black scaly skin apparently unaltered beneath the fungous growth, which was readily peeled off; second, because it covered the rather elongated claws of the bird with as thick and firm a coating as that found upon the adjacent portion of the toes supplied with its modified cuticle; and thirdly, from the absence of epithelial or other similar cells in the sections examined, even with a high power (1200 diam.) Any hypothesis of its being a malignant growth springing from the connective tissue beneath the integument was likewise deemed untenable, not only on account of the circumstances just enumerated, but also because the disease was so symmetrically developed upon both lower extremities; and your Committee was therefore, with some hesitation, led to assume that the growth was really of a fungous nature, and perhaps bore some slight resemblance to those comparatively rare affections of our race, *Favus* and *Tinea scutellaris* of the nails. The only fact which militated strongly against this view was that, on burning a small fragment of the abnormal structure in the flame of a spirit lamp, a decided animal odor was evolved, and a faint cloud of ammoniac-nitrate appeared when the smoking particle was brought in contact with the vapor of nitric acid. Even this might be readily explained by the existence in the mass of the various animal excretions with which such a dense covering would probably be charged.

All of which is respectfully submitted,

(Signed)

JOS. G. RICHARDSON,  
HARRISON ALLEN.

Sept. 23d, 1870.

On motion, the report was accepted, the Committee discharged, and the Corresponding Secretary directed to transmit the document to the Smithsonian Institution.

A communication was presented from Prof. Baird, of the Smithsonian Institution, accompanied by a specimen of finely pulverized material stated to have fallen in a dust shower over portions of Vermont; to examine which Drs. J. G. Hunt and William Corbit were appointed.

Sundry photographs, specimens of skin and some animal organisms, dredged from the harbor of Newport, R. I., received from J. Powell for distribution among the members, was presented

November 7th, 1870.

Vice-Director, WM PREPER, M.D., in the Chair.

Nine members present.

Dr. J. G. Hunt presented the following report in regard to dust shower, which was accepted, the Committee discharge the Corresponding Secretary requested to forward the same to the authorities at the Smithsonian Institution.

The Committee to whom the dust, sent by H. A. Cutting, and said to have fallen from the air in Vermont Feb 12, 1870, was referred for examination make the following report

The dust effervesced under the action of an acid.

On microscopical examination we find as follows.

1st. Much granular amorphous matter

2d. Many round or oval granules, perfectly transparent. These when treated with nitric acid. It is probable that silica forms their composition.

3d. Spores of fungi or gonidia of some lichen.

4th. Diatoms.

5th. Fragments of vegetable cells, too imperfect for identification.

6th. Cells of coniferous wood—the genus *Pinus*—having the position characteristic of these cells absent in spots.

7th. Other cells of coniferous wood with smaller markings than pine, five dots in a row and two parallel rows in each cell, and terminating transversely and not obliquely as in the pine.

8th. Many cells of an *Alga*, resembling red snow, or *Protococcus*, *Palmella cruenta*, or *Porphyridium*, as the unfortunate plant is called. These cells were in the stage of binary subdivision, well known.

We see no reason to doubt that this dust is the ashes of some forest which has been sitting the higher regions of the atmosphere.

Dr. Tyson inquired of Dr. Hunt whether the effervescence with acid did not indicate that the dust was composed of carbonates, to which question Dr. Hunt replied in the affirmative.

---

November 21st, 1870.

(Conversational Meeting.)

Director S. W. MITCHELL, M. D., in the Chair.

Twelve members present.

Dr. Mitchell read an interesting account of a case of supposed Guinea worm in a patient from South Carolina, showing the worm itself, presumed to be allied to the *Dracunculus*, which he intended to present at the approaching business meeting, and make application for permission to publish the paper in the next number of the *American Journal of the Medical Sciences*.

In the course of the conversational discussion to which this gave rise, Dr. MITCHELL stated that a similar case had occurred at the Wills' Hospital some years since.

Dr. COATES remarked that not very long ago a horse was on exhibition, and had been seen by many medical gentlemen, in which a worm was distinctly visible within the aqueous humor. He further inquired whether it was known what mode of travelling through the tissues was adopted by the ova in these cases.

Dr. HOLT thought there was little doubt that they made their first entrance into the system in the water used for drinking.

Dr. TYSON considered that their mode of progress among the structures of the body might be somewhat analogous to the remarkable amœboid movements of the white blood corpuscles.

Dr. MITCHELL mentioned in this connection a case where a piece of blunt-pointed iron wire was removed at the instep of a patient whose leg it had entered above the knee some time before.

Dr. COATES finally wished to know how the ovum of this parasite could have made its way through the patient's flesh, been swallowed in the water which she drank, or even existed at all in her neighborhood, when no other specimen of its kind had ever been known to occur in the State of South Carolina.

---

December 5th, 1870.

(Annual Meeting.)

Director S. W. MITCHELL, M. D., in the Chair.

Fourteen members present.

Dr. Mitchell requested that the paper of Dr. Priolieu, read at the last conversational meeting, should be referred to a committee for publication, if approved. On motion of Dr. Kenderdine, it was voted that Dr. Leidy be appointed a Committee of one, to whom the specimen and communication be referred.

Reports of the Recorder, the Corresponding Secretary and the Treasurer, each giving abstracts of the affairs and transactions of

the Section in their several departments during the year, were and accepted.

Dr. Isaac Norris and Mr. Warner were appointed to examine Treasurer's account, and, after investigation, reported that it found to be correct.

The annual elections being next in order, Dr. J. H. McQuillan and Mr. T. W. Starr were requested to act as tellers, and the department proceeded to elect officers for the ensuing year, as follows:

|                                 |   |   |   |                              |
|---------------------------------|---|---|---|------------------------------|
| <i>Director,</i>                | . | . | . | S. W. Mitchell, M. D.        |
| <i>Vice-Director,</i>           | . | . | . | Wm. Pepper, M. D.            |
| <i>Recorder,</i>                | . | . | . | Jos. G. Richardson, M. D.    |
| <i>Corresponding Secretary,</i> | . | . | . | Prof. J. H. McQuillan, M. D. |
| <i>Treasurer,</i>               | . | . | . | L. S. Bolles, M. D.          |
| <i>Curator,</i>                 | . | . | . | W. H. Walmsley.              |

*Publication Committee.*

|                                     |                      |
|-------------------------------------|----------------------|
| <i>Recorder, ex off., Chairman,</i> | L. S. Bolles, M. D., |
| F. W. Lewis, M. D.,                 | M. W. McAllister,    |
| W. Pepper, M. D.,                   | J. G. Hunt, M. D.    |

*Committee of Curators.*

|  |                         |
|--|-------------------------|
| Wm. H. Walmsley, <i>ex off., Chairman,</i> |                         |
| T. W. Starr,                               | Wm. F. Norris, M. D.,   |
| F. W. Lewis, M. D.,                        | J. G. Richardson, M. D. |

*Committee of Auditors.*

|                       |              |
|-----------------------|--------------|
| H. M. Bellows, M. D., | J. W. Queen, |
| W. McFadden.          |              |

---

December 19th, 1870.  
(Conversational Meeting.)

# INDEX.

---

|  |             |
|--|-------------|
| Allen, Prof. Harrison .....                                | 9           |
| Amœboid movement in nuclei of vegetable cells .....        | 3           |
| Atropia and hydrocyanic acid .....                         | 5           |
| Bilharzia hæmatobia .....                                  | 3           |
| Calcified dentine .....                                    | 12          |
| Case of Hypospadias, male hermaphroditism .....            | 7           |
| Case of so-called exostosis .....                          | 12          |
| Case of supposed Dracunculus .....                         | 11          |
| Class microscopes .....                                    | 2           |
| Chelifer, species of .....                                 | 12          |
| Coates, B. ....  | 11          |
| Corbit, Wm. B. ....  | 9           |
| Dentinal fibrili, of Tomes .....                           | 1           |
| Dust shower in Vermont .....                               | 9, 10       |
| Grimaldia barbifrons .....                                 | 4           |
| Gold and silver staining of tissues .....                  | 3           |
| Hunt, J. G. ....   | 3, 4, 9, 10 |
| Johnson, Prof. Christopher .....                           | 7           |
| Keen, W. W. ....   | 2, 5        |
| Kenderdine, R. S. ....                                     | 4           |
| McQuillen, Prof. J. H. ....                                | 1, 2, 4, 12 |
| Mitchell, S. W. ....                                       | 3, 11       |
| Myiarchus cinerascens .....                                | 4, 9        |
| Norris, Wm. F. ....  | 3           |
| Priolien, Dr. J. F. ....                                   | 11          |
| Powell, Samuel .....                                       | 10          |
| Richardson, J. G. ....                                     | 9           |
| Saxafraga sarmentosa .....                                 | 3           |
| Starr, T. W. ....  | 2, 12       |
| Testicle of male hermaphrodite .....                       | 2           |
| Tyson, Prof. James .....                                   | 2, 10       |
| Walmesley, W. H. ....                                      | 2           |
| Woodward, Col. J. J., report of on photo-micrography ..... | 3           |



**PROCEEDINGS**  
**OF THE**  
**ACADEMY OF NATURAL SCIENCES**  
**OF**  
**PHILADELPHIA.**

- - -  
**1871.**  
- -

**PUBLICATION COMMITTEE.**

**JOSEPH LEIDY, M.D.,**                      **WM. S. VAUX,**  
**ROBERT BRIDGES, M.D.,**              **GEO. W. TRYON, JR.,**  
   **EDW. J. NOLAN, M.D.**

**PHILADELPHIA:**  
**ACADEMY OF NATURAL SCIENCES,**  
**Corner of Broad and Sansom Streets.**  
**1871.**

HALL OF THE ACADEMY OF NATURAL SCIENCES.

PHILADELPHIA, April 9, 1872.

I hereby certify that printed copies of the Proceedings for 1871 have been presented at the meetings of the Academy, as follows:—

|       |            |   |   |   |          |           |
|-------|------------|---|---|---|----------|-----------|
| Pages | 9 to 40    | . | . | . | May      | 2, 1871.  |
| "     | 41 to 56   | . | . | . | "        | 9, 1871.  |
| "     | 57 to 88   | . | . | . | June     | 6, 1871.  |
| "     | 89 to 120  | . | . | . | July     | 11, 1871. |
| "     | 121 to 136 | . | . | . | "        | 18, 1871. |
| "     | 137 to 152 | . | . | . | August   | 1, 1871.  |
| "     | 153 to 184 | . | . | . | "        | 13, 1871. |
| "     | 185 to 216 | . | . | . | October  | 24, 1871. |
| "     | 217 to 232 | . | . | . | November | 28, 1871. |
| "     | 233 to 243 | . | . | . | December | 12, 1871. |
| "     | 245 to 276 | . | . | . | January  | 16, 1872. |
| "     | 277 to 324 | . | . | . | February | 13, 1872. |
| "     | 325 to 340 | . | . | . | March    | 19, 1872. |

# LIST OF CONTRIBUTORS,

*With reference to the several Articles contributed by each.*

For Verbal Communications see General Index.

|   |     |
|---|-----|
| <b>Cope, E. D.</b> Ninth Contribution to the Herpetology of Tropical America .....  | 200 |
| On the Fishes of the Ambyiacu River.....  | 250 |
| <b>Coues, E.</b> Notes on the Natural History of Fort Macon, N. C., and vicinity (No. 1).....                                 | 12  |
| Same (No. 2).....   | 120 |
| <b>Lawrence, Geo. N.</b> Descriptions of New Species of Birds of the Families Troglodytidae and Tyrannidae.....               | 233 |
| <b>Lea, I.</b> Description of three New Species of Exotic Unionidae.....  | 188 |
| Descriptions of twenty New Species of Uniones of the United States  | 189 |
| <b>Meehan, T.</b> Morphology of Carpellary Scales in Larix.....   | 106 |
| <b>Meek, F. B.</b> Descriptions of New Species of Invertebrate Fossils from the Carboniferous and Devonian Rocks of Ohio..... | 67  |
| Description of New Species of Fossils from Ohio and other Western States and Territories.....                                 | 159 |
| Notice of a New Brachiopod from the Lead-bearing Rocks at Mine La Motte, Missouri.....  | 185 |
| Descriptions of new Western Palaeozoic Fossils, mainly from the Cincinnati Group of the Lower Silurian Series of Ohio.....    | 308 |
| <b>Newton, A.</b> On certain Species of Falconidae, Tetraonidae, and Anatidae   | 94  |
| <b>Ozden, J. A.</b> Synopsis of the Genus Chettusia (Lobivanellus), with a description of a new species .....                 | 194 |
| <b>Rand, Theo. D.</b> Notes on Feldspars and some other Minerals of Philadelphia and vicinity.....                            | 209 |
| <b>Streets, T. Hale.</b> Descriptions of five New Species of Crustacea from Mexico .....                                      | 225 |
| Catalogue of Crustacea from the Isthmus of Panama, collected by J. A. McNeil.....   | 238 |
| <b>Thomas, Prof. C.</b> Contribution to Orthopterology.....   | 194 |



PROCEEDINGS  
OF THE  
ACADEMY OF NATURAL SCIENCES  
OF  
PHILADELPHIA.

---

NEW SERIES.

---

PART I. 1871.

---

JANUARY 3, 1871.

Mr. WM. S. VAUX, Vice-President, in the chair.

Twenty-four members present.

The following paper was presented for publication:—

“Notes on the Natural History of Fort Macon, N. C., and vicinity. No. 1.” By ELLIOTT COUES.

PROFESSOR O. C. MARSH, of Yale College, exhibited a tooth of a new species of *Lophiodon*, from the Miocene of New Jersey, which was the first indication yet discovered of remains of the Tapiridæ on the Atlantic coast, or of the genus *Lophiodon* in this country, east of the Rocky Mountain region. The tooth, which was in a perfect state of preservation, was the first true molar of the left upper jaw. It measured across the crown seven lines in antero-posterior diameter, and eight and one-quarter lines in transverse diameter. This would indicate an animal intermediate in size between *L. occidentalis* and *L. modestus* of Dr. Leidy. From the latter species it may readily be distinguished by the enamel of the crown, which is smooth and not wrinkled. As this species is evidently distinct from any described, Professor Marsh proposed for it the name *Lophiodon validus*. The specimen was found in the miocene marl of Cumberland County, New Jersey, and appeared [May 2, 1871.]

rently at about the same horizon as the *Elotherium Leidyanum*, and *Rhinoceros matutinus* Marsh, from Monmouth County, in the same State.

---

JANUARY 10.

Mr. WM. S. VAUX, Vice-President, in the chair.

Thirteen members present.

---

JANUARY 17.

Dr. CARSON, Vice-President, in the chair.

Twenty-five members present.

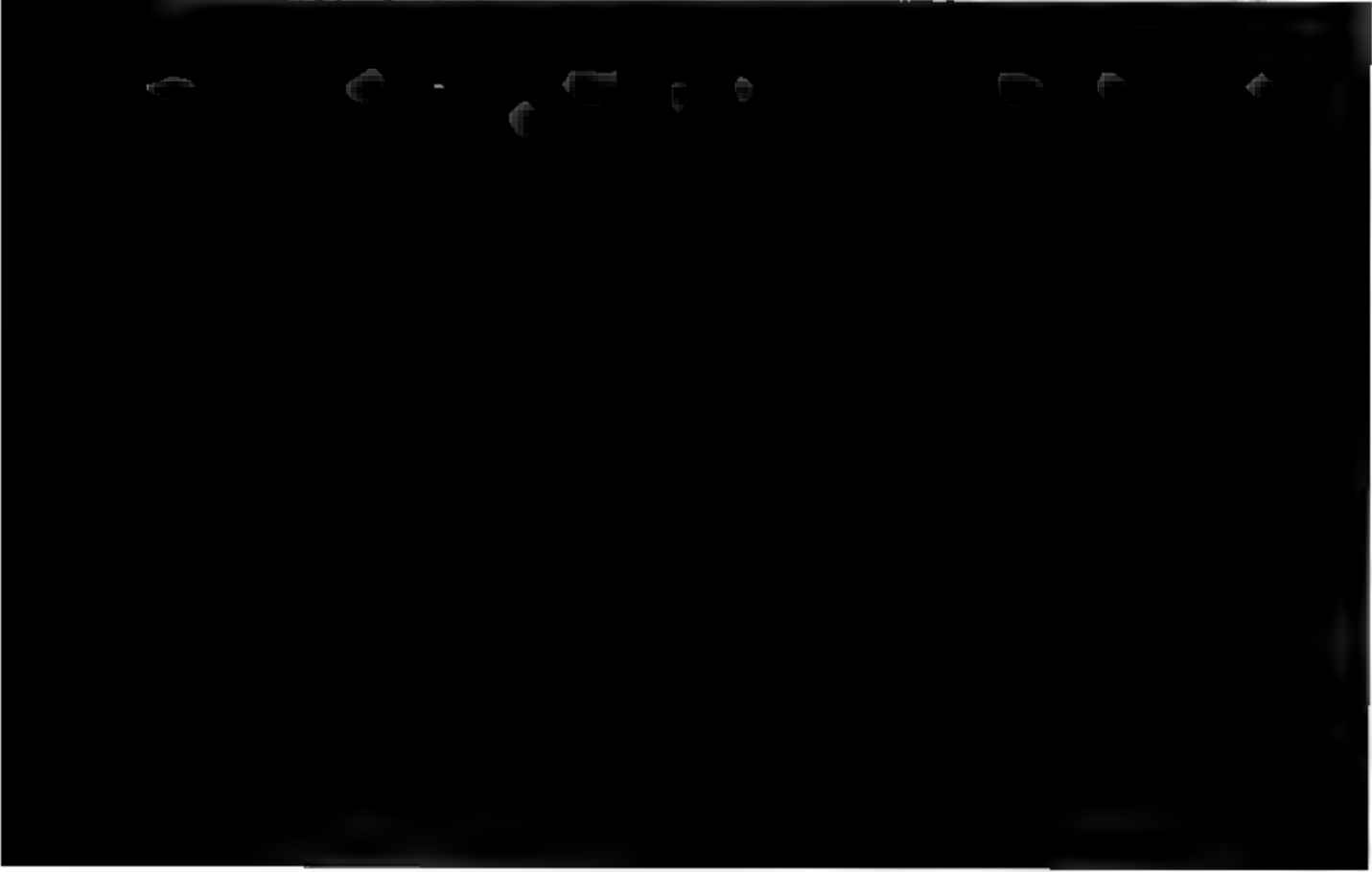
---

JANUARY 24.

Mr. VAUX, Vice-President, in the chair.

Eighteen members present.

Mr. THOMAS MEEHAN presented a fruit of a pear, which presented the external appearance of an apple, gathered from a Tyson pear tree growing in the garden of Dr. Lawrence, of Paris, Canada. Dr. Lawrence had a Rhode Island greening apple near the pear tree, and some of the latter interlaced with it. The pear tree was full of blossoms last spring, but only those interlacing bore fruit. They had all the appearance of apples, so much so, that many who had seen them had supposed there must have been some mistake as to Dr. Lawrence gathering them. Dr. L. had, however, when he first saw them, obtained Mrs. Lawrence's



fertilization with the apple. In the latter case, if found true, it would have an important bearing on the question often mooted, whether cross-fertilization effected change immediately in the fruit impregnated, or that change only appeared after the germination of the impregnated seeds. In the case of varieties of Indian-corn, we know the change is immediate; and it was generally believed some *cucurbitaceous* plants furnished similar facts; but he thought it had not been known in other plants, especially in the case of species as distinct as were the apple and the pear.

---

JANUARY 31.

Mr. JOS. JEANES in the chair.

Twenty-two members present.

The report of the Biological and Microscopical Section was presented.

Twenty members not being present when the election of committees was in order, the committees elected in 1870 were continued for 1871.

The election of members was postponed until the next business meeting.

On favorable report of the committee, the following paper was ordered to be published:—

1871.]

NOTES ON THE NATURAL HISTORY OF FORT MACON, N. C., AND  
VICINITY. (No. 1.)

BY ELLIOTT COUES.

During two years' residence in this locality, I paid some attention to the zoology and botany of the vicinity, and the information obtained may be of some value to others besides myself. The present paper, in which mammals, birds, and reptiles are noticed, may be followed by one or more treating of the fishes, insects, marine invertebrates, and plants.

I. MAMMALS.

*Lynx rufus*, Raf.

Occasional.

*Valpes virginianus*, Rich.

*Putorius vison*, Gapper.

*Lutra canadensis*, Sabine.

These three, but especially the mink, are common, and, with the first-named and the following species, represent the fur-bearing animals of the immediate vicinity which are of commercial consequence.

*Procyon lotor*, Storr.

Syn. *P. lotor* var. *Mexicana*, St. Hilaire, Voy. Venus, I, 1855, p. 25, pl.

6.—*P. Hernandezii*, Wagler, Isis, xxiv, 1831, p. 514.—*P. Hernandezii*

Var. *Mexicana*, Bull. Mus. N. A. 1857, p. 212.—*P. lotor*, Gray.

the authors above quoted. As Mr. Allen<sup>1</sup> holds, and probably has shown, all the features believed to distinguish the western raccoons may be discovered in examination of sufficiently extensive series of eastern ones. Dr. Gray's two species are not different, according to that author's subsequent admission.

***Cariacus virginianus*, Gray.**

Common, almost to be called abundant in wooded portions of the main land near the coast, and said, upon good authority, to occur in the wooded part of the Banks. During the autumn and winter, venison is not much more expensive than beef, a fact attesting the above statements.

**? *Balæna cisarctica*, Cope.**

An individual, which I rather suppose than know to be of this species, was taken in May, 1869, off Shackleford. It measured about forty-five feet in total length. The fishermen called it a "right whale." Besides this kind, they spoke of two others, that they occasionally captured, under the names of "Scrag" and "Humpback" (*Agaphilus* sp? and *Megaptera* sp?). They usually take two or three each spring. Remains of whales, as the jaw-bones, shoulder-blades, humeri, and especially vertebræ, are strewn abundantly along the beach.

***Delphinus* Sp.**

At least one species of porpoise is very abundant in and about the harbor, and I think that a second, smaller and darker than the other, is of frequent occurrence. They are to be seen at all times, but are most abundant in spring and fall, during the migration of the fish upon which they prey; and in April and May, during the pairing season, they become especially conspicuous in their amatory gambols. The sexual act is frequently witnessed, and may be recognized at a distance by the reversed position of one of the pair, and the smoothing of the surface of the water by the wasted emissions. The great voracity of the porpoises is evident in their pursuit of schools of fish, some of which are often driven out of the water, only to fall back into the open jaws of the pursuers. The animals are sometimes taken for their oil, in nets made especially for the purpose, but are not

<sup>1</sup> Bull. Mus. Comp. Zool., No. 8, pp. 182-3.

often molested, and usually show entire fearlessness of the nearness of man.

Remains of some cetacean (not a whale), about seventeen feet long, were cast upon the beach during a storm in October last, but identification was impossible, owing to the advanced stage of decay.

*Lanius cinereus*, Allen.

Occasional specimens, in summer.

*L. noveboracensis*, Gray.

Very abundant in summer, and appearing to live mostly in and about the fort itself, as far as the eastern extremity of the island is concerned; other suitable hiding-places not being in plenty.

*Scalops aquaticus*, Fischer.

Occasional traces of this animal's presence in the loose soil between the sand-hills and the marsh.

*Sciurus carolinensis*, Gmelin.

Very abundant in all the wooded vicinity.

*Mus domesticus*, Pallas.

*M. musculus*, Linn.

Everywhere about the fort and other settlements.

*Fiber zibethicus*, Cuvier.

Common.

*Lepus sylvaticus*, Bach.

One specimen from the neighboring island of Shackleford—the



weeds, or little shrubby patch, in a dry situation. It is sunk a little in the ground, then arched over, with an opening on one side; built of dried grasses, mixed with a few leaves, and warmly lined with the animal's own fur. All those I have seen were so far from water as to be out of reach of any possible rise of the tide.

This appears to be the most distinct of the several species closely related to the foregoing; and is in fact distinguishable on sight, as some of the others are not.

***Didelphys virginiana*, Shaw.**

SYN. *D. californica*, Bennett, P. Z. S., i, 1833, p. 40.—*D. breviceps*, Id., ibid.—*D. pruinosa*, Wagner, Suppl. Schreber, iii, 1843, p. 40.

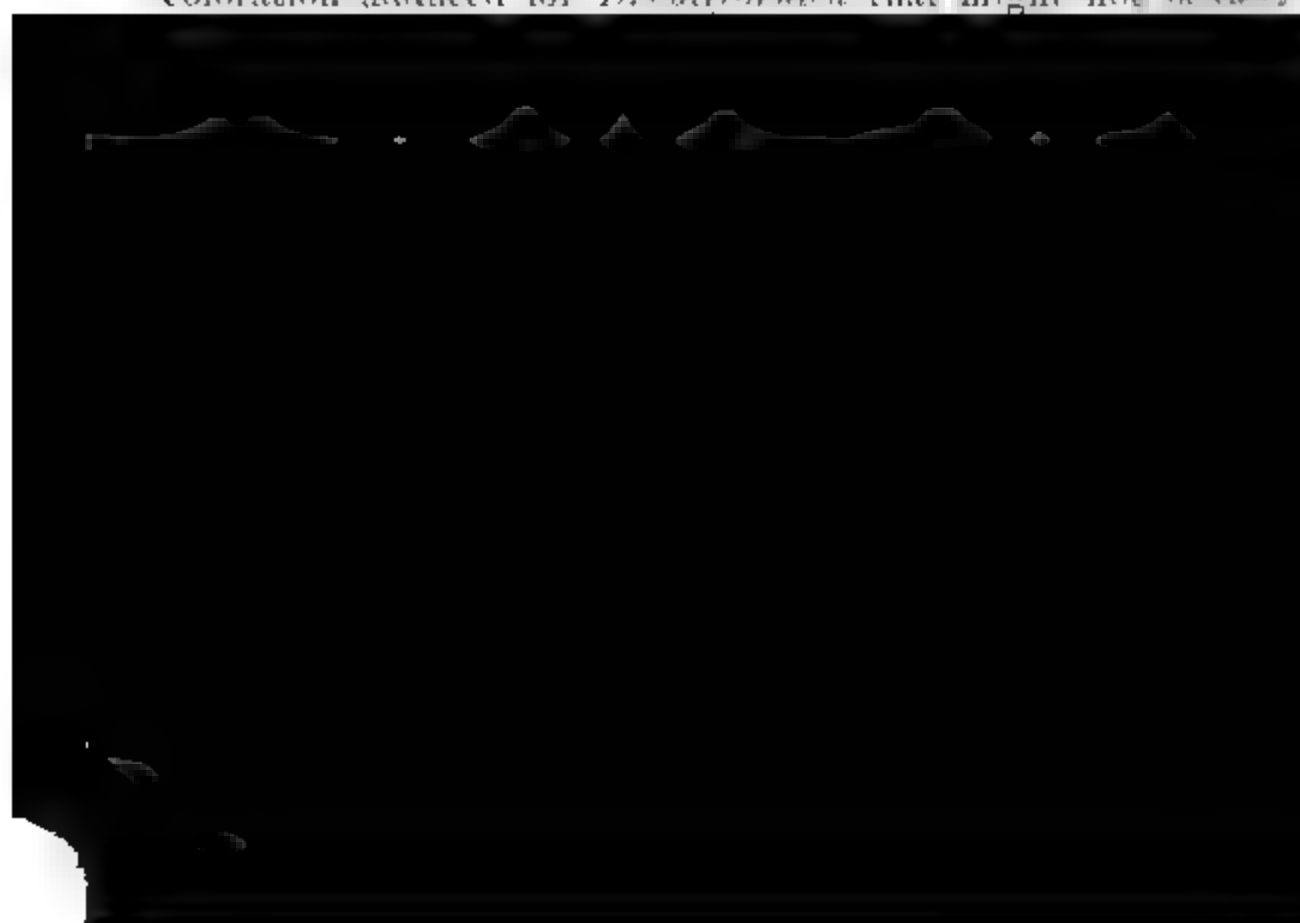
Abundant in the wooded portions of the vicinity.

Having made this animal a special study, I am in position to offer remarks which cannot be reasonably questioned. Although my investigations were rather anatomical than zoological, I did not neglect the latter portion of the subject. The more specimens I examined, the more I was struck with the variations that depend upon sex and age, as well as those that different individuals corresponding in these conditions present. An examination of these points in the natural history of a single animal, may give results of general application. And yet, in calling attention to the variability of the opossum, I do not wish to be understood as supposing that the animal is not as constant as many or most others; for I believe it to be no exception to a general standard or average in this respect. I doubt that one could study any mammal as closely as I have the opossum, without being similarly impressed. The following paragraphs are mainly confined to consideration of external characters. I can affirm that not one of the characters assigned to the supposed species above cited, is not to be found in specimens of *D. virginiana* from the same locality; that the differences indicate individual peculiarities; and that even upon striking an average of preponderance of certain characters, common to each in various degree, no results will be obtained warranting the separation of the opossums from the southwest as even a geographical race or variety. The assertion is made, it should be understood, upon consideration of descriptions only, without direct comparison of specimens.

Professor Baird remarks (Mex. B. Survey, vol. ii, pt. ii, p. 33), that "although there are some differences in the skulls of the *D.* 1871.]

mostly naked, reminding one of the texture of a bat's wing. In color, they are like the tail; usually dark, blotched or rimmed with flesh-color; but they may be wholly blackish or mostly whitish; it is impossible to base any character upon their coloration. The general shape of the conch may be called pyriform (base uppermost) or subcircular; but it is not easy to see what the shape really is, unless the ear is pressed out flat. From their texture, they shrink and shrivel in drying. I have never seen a Virginian opossum with so pointed an ear as "*D. californicus*" is represented to possess in pl. iii. of the Mexican Boundary Survey; but if, as I presume, the drawing was made from a dried specimen, it is not trustworthy in this point, for indeed the true shape of the ear could have been only guessed at. The ears, like the tail, are peculiarly subject to disease; and may ulcerate away entirely, as I have observed in animals kept in confinement; and this, too, without appreciable general ill-health.

The general body colors are amongst the most variable features. The variation is largely a matter of individual difference; but there are certain things that influence it in a general way; especially age. The opossum grows gray with age, as a rule; half-grown ones seen at a little distance give the impression of a blackish animal; old ones, of a whitish animal. The paws are particularly variable. Generally, they are among the darkest parts, and are often quite blackish; frequently, they are as pale as any other parts. Not to go into tedious particulars in this connection, I may say, in short, that I have seen no points of coloration adduced for *D. californicus* that might not be easily



the locality at large, seemed to promise the more of real interest. At the same time it should be remembered, that any of the *Pas-seres*, &c., of the wooded main land adjoining, not here noted, may occasionally stray into the shrubbery of the sand-bars. The catalogue of the water birds is believed to be pretty full. Aside from these, and excepting a few maritime land birds like the *Am-modrami* for example, the bird-fauna of the locality appears to differ from that of the State at large, mainly in the absence during the breeding season of species that, like the robin and meadow-lark, pass the summer as well as other seasons in higher parts, and perhaps, also, in a rather earlier arrival in spring, and later departure in the fall, on an average, of the migrants.

***Turdus migratorius.***

Spring and fall, especially March and November; some winter; none observed in summer.

***Turdus pallasi.***

Spring and fall, occasional, in the shrubbery; spec. in Nov. As elsewhere<sup>1</sup> noted, this species migrates earlier in the spring and later in the fall than its nearest allies; and I have no doubt that it winters in this vicinity.

***Turdus aliciae.***

Like the last, but later in coming; specs. in April and May.

***Mimus polyglottus.***

Resident; common; but not so abundant as it is inland, and especially somewhat further south.

***Mimus carolinensis.***

Resident; common; but most numerous during the migration.

***Anthus ludovicianus.***

Abundant, in flocks, from early in November till April.

***Thryothorus ludovicianus.***

Common; resident; mates in March; nests and lays in April; young obtained May 9.

***Telmatodytes palustris.***

Abundant, particularly during the migration. It continues in plenty through part of November at least, and I think that some

<sup>1</sup> Coues and Prentiss, Smithsonian Report for 1861, p. 404  
1871.]



***Dendroeca palmarum.***

Rather frequent, particularly late in the fall, in low shrubbery, with the sparrows.

***Progne purpurea.***

Common, March to October; as many as can find accommodation breed about the fort.

***Hirundo horreorum.***

During the migration only; then abundant.

***Hirundo bicolor.***

Abundant during the migration. Numbers made their appearance January 11, 1870, on a warm day, though there had been ice a half inch thick two days before. They almost immediately disappeared during some blustering weather, but reappeared in greater numbers than before on the 20th, and were occasionally seen from that time until the regular migration took place, in April.

***Cotyle riparia.***

During the migration.

***Vireo novæboracensis.***

Common summer resident of the shrubbery, April—October.

***Vireo olivaceus.***

Occasionally seen, during the migration.

***Pyrrhula æstiva.***

Frequent, in summer.

***Chrysomitris tristis.***

Common, in flocks, from November to April. Here it spends much of its time on the ground, feeding apparently in greatest part upon the seeds of *Cenchrus tribuloides*.

***Passerculus savanna.***

The characteristic sparrow; very abundant everywhere outside the marsh itself, from October to May; none remain through the summer. Its numbers do not perceptibly decrease until the middle of April, when the greater part move northward; but loiterers are seen through most of May. Their earliest connected notes are heard late in March; and they are in full song and

1871.]

plumage before they leave. Some straggle back in September; more arrive in October, and the full complement appears with the first cold weather of November.

*Zonotrichia albicollis.*

Only occasional, in winter and during the migrations; although very abundant on the neighboring mainland.

*Melospiza melodia.*

Common; resident; but most numerous from October to April, as most of them pass northward for the summer.

*Melospiza palustris.*

Common; resident, I think, as I saw them after May, although I did not observe them through either of the two summers. They seemed most plentiful in November, when many were singing. The ordinary chirp of this species is totally different from that of the last. A timid bird, courting the seclusion of the thick bushes that border the marsh, it forms a sort of connecting link between the two last species that frequent open grassy places and sparse shrubbery, and the two next, that are confined to the marsh itself.

*Ammodramus caudatus.*

Living side by side with the next, and with the same general habits and manners, the sharp-tailed finch nevertheless has some obvious peculiarities, as compared with the seaside. As the two species spring up together from the reeds, the sharp-tailed is recognized at a glance by its inferior size, and its general yellow-

developed sexual organs, from the beginning of April; while the sharp-tailed remained in moult through the same month. This, of itself, is a good indication of some notable difference in the time, and probably the places, of breeding. I do not think that any of the sharp-tailed finches breed hereabouts; and it was not until May, when they appeared to be about leaving, that I found any with excited organs, or in perfect plumage. At that date the seashores were mating and nesting, if not already incubating. In the fall, when both species are again together, it is only during a part of the season that they are found in equal numbers. This is during the warm days of October, when they loiter in troops about the bushes around the edges of the marsh, as well as among the reeds. Previously, in September, there are few of the sharp-tailed to be seen; and on entering the marshes in November, the seashores will be found scarce or altogether wanting, while the former are still abundant. These observations, which I made very carefully, are mutually explanatory, and point to the fact that these two species, so closely allied, so often found together, and so commonly spoken of in identical terms, have really a different range of habitat (one being more northerly than the other), migrate independently of each other, moult at separate seasons, and breed more or less apart.

***Ammodromus maritimus.***

More numerous, on an average, than the last, and more truly characteristic of the locality, as it breeds here in great numbers. In April it retires from the interior of the marsh, to place its nest among the bordering bushes, a little above high-water mark. It begins to sing when mating, and is afterwards, during the incubating, particularly earnest and persevering about it. Each pair usually claims some particular copse, and the male has his favorite singing post, to which he continually resorts. The simple song is something like that of the yellow-winged sparrow, beginning with a few slow notes, then a rapid trill, finally slurred till it sounds like the noise made by some of the grasshoppers. The nest and eggs are now well known. The young in September are somewhat differently streaked from the adults, and appear to constitute Audubon's *A. macgillivrayi*.

The comparison that has been drawn between the actions of the Ammodromi and of Sandpipers seems somewhat forced, and

1871.]

a more natural one might be traced in the Nuthatches, Titmice, and even Woodpeckers. They climb the reeds with remarkable ease, sliding up and down, skipping from one to another, and hanging in every attitude except head downwards; they are doubtless much aided by the somewhat stiffened tail. On the ground, they are unmistakably sparrow-like, and always proceed by hopping; the flight does not differ noticeably from that of their several near allies. It is irregular and very quick, and they never remain long on wing. They are rather difficult to procure in large numbers, independently of the miry nature of the places they inhabit; as they are not often, comparatively, seen at rest, and it is quite a knack, only acquired by practice, to shoot at them on wing with any certainty of killing. A collector will do well to take a score of them in a morning's walk, even when they are most abundant.

Comparing the Fringillidæ of this seacoast locality with those of inland places of the same latitude, the distinctive features are seen in the *Ammodromi*, and in the great abundance of *Passerculus*, together with the absence or only casual occurrence of several species elsewhere abundant. Thus, I never saw a Chipping Sparrow, Yellow-winged Sparrow, Bay-winged Bunting, or Snow-Bird, on the island.

*Pipilo erythrophthalmus.*

Common; summer resident, breeding; and just possibly a few spend the winter here, though I do not think I saw any between November and March.

*Cardinalis virginianus.*

Common; resident; breeds (in May and subsequently).

*Icterus spurius.*



latter part of January, begin to sing in March, get restless in early April, when they come into full feather, but continue in flocks for a week or two longer. The greater number then pass off northward, and those that remain begin to pair. They breed sometimes by the single pair, sometimes in companies with the jackdaws, and have their first eggs early in May; though other hatches may be found throughout June and part of July. I estimated that a narrow strip of brushy ground about two miles long contained about a hundred pairs. The young begin to flock about the middle of July; there may have been about a thousand in the tract just mentioned, before they were reinforced, in August, by new-comers from the north.

*Sturnella magna.*

Very abundant, in flocks, from October to April, when they pass north, or at any rate to higher grounds inland. I saw none breeding, and do not think I ever observed a pair during the summer.

*Quiscalus major.*

The characteristic species of the family, and very abundant. I judge it to be resident, though it is much less common during December and January, and may move off altogether during the extreme of the season. It does not seem to be authenticated as occurring beyond the Middle States; and, however far north it may occasionally stray in summer, it is essentially a bird of the South Atlantic and Gulf States. It is strictly maritime, and its food differs from that of most of its allies, much as that of the fish-crow does, in comparison with that of *C. americanus*. It feeds on molluscs, aquatic insects, fiddler-crabs, and small fry, which it catches expertly by wading in the water and striking with its bill, in a manner reminding one of a heron. It frequents the muddy flats at low tide, and for similar animal food, and is dispersed through the marsh in gleaning for seeds that form part of its fare. The sexes mingle in flocks, often of large size, up to some time in April, when they break up in pairs, several associating together in the same copse, and placing their nests close together in a sort of rookery, frequented also by the redwings and the green herons. The nests are bulky and inartistic, composed chiefly of interlaced twigs and intertwined grasses, generally with the addition of a few dried leaves as lining or wadding; 1871.]

I saw none with either mud or horsehair. The laying season is at its height the third or fourth week in April; I did not find more than six, nor fewer than three, eggs in a nest. They measure on an average  $1\frac{1}{4}$  by a little over  $\frac{3}{4}$  inch; and have the usual shape and curious zigzag markings, on a pale bluish-green ground color. On leaving the nest, the young are curious-looking objects—clear brown above, pale gray or almost white below, with a naked space about the eyes, and fluffy tufts of down on the head. They appear early in June, and by the first of August both old and young are flocking. The young rapidly change after leaving the nest, the brown acquiring a greenish-black cast, the gray of the under parts becoming brown. Both sexes undergo a change in the early fall, after rearing of the young is over, and again in the spring. The moult begins on the head, and progresses backward, the quills and tail-feathers being renewed last. When in perfect plumage, the male is a splendid-looking bird; its large fan-shaped tail, with the lateral feathers placed slantwise, giving it a jaunty air, and serving to steady its flight. A fuller account of this interesting species will be found in the "Ibis," 1870, p. 367.

*Corvus ossifragus.*

Very common, and resident, though less numerous in summer, and not to my knowledge breeding in the immediate vicinity, probably through lack of suitable woods. They frequent the sea beach, contending with the turkey-buzzards and herring-gulls for the refuse from the fort, and scatter over the marsh, often in company with the last species, feeding on various animal substances

***Meegus erythrophthalmus.***

Frequent, during the migration.

***Colaptes auratus.***

Rare or occasional (one specimen taken October 10, 1870).

The *Picus querulus*, although not actually observed on the island, may be here noticed, as one of the characteristic species of the South Atlantic States, and an abundant bird of the pine swamps of the neighboring mainland, where it is resident. It is easily distinguished from our other *Pici* proper, at any reasonable distance; first by its different note, and next by the greater blending of its colors, producing a grayish appearance at a distance where the other species still look definitely black and white. The sexes are exactly alike, except that the ♀ lacks the red over the auriculars, and of the same size; average measurements give  $8\frac{1}{2} \times 15 \times 4\frac{1}{2}$ ; tail  $3\frac{1}{2}$ .

***Spizella socialis.***

Frequent; apparently resident.

***Aspiter cooperi.***

Frequent; apparently resident.

***Aspiter fuscus.***

Specimen in September.

***Circus hudsonius.***

Very common; resident.

***Haliaeetus haliaetus.***

Common, especially in spring and fall.

***Haliaeetus leucocephalus.***

Frequently observed at different seasons.

***Strix pratensis.***

Occasional; specimen taken in the marsh in daylight.

***Brachyotus palustris.***

Frequent, about the marsh.

***Cathartes aura.***

Abundant; resident; more numerous in summer than in winter; believed to breed in the neighboring pine swamps.

1871.]

***Cathartes atratus.***

This species was observed in summer too frequently to be considered as merely a straggler, though it is far less abundant here than on the coast of the next State southward. Numbers were seen *March 22d*, 1870 (their first appearance that year); and in *November* of the same year I saw many near New Berne, N. C.

***Zenaidura macroura.***

Resident; abundant; begins to flock in August, and so continues until April.

***Ortyx virginianus.***

Casual on the island, which is not entirely suited to its wants; plentiful in the vicinity.

***Charadrius virginicus.***

Common during the migration, particularly in October and November.

***Aegialitis vociferus.***

Abundant, especially during the migration, but observed at all seasons, and probably resident, though not known to breed.

***Aegialitis semipalmatus.******Aegialitis melodus.***

These two species come and go together, and are usually found in company; but the first named much outnumbers the last. They become very plenty in April, and so continue through that month and the next, after which none are to be seen until the

Iris brown; no conspicuous coloring of the edges of the eyelids; bill wholly black; legs pale flesh-color, sometimes with a livid, at others with a yellowish, tint. Shade of the upper parts intermediate between that of *melodus* and of *semipalmatus*; ♂ with a perfect black pectoral collar and bar across the vertex, the nape and cervix strongly tinged with rufous, as in the western species; ♀ with the bars plain grayish-brown, and with little rufous; young, like the female, but duller and grayer. When newly hatched, the down of the upper parts is curiously variegated with brown and black; the under parts are pure white; the bill and feet are as in the adult.

None of these Plovers winter here. They come from the south late in March, with constant increase during April; a part pass further north in May, but many remain to breed. Excepting a few stray sandpipers, they are the only waders of the beach during June and July. Before pairing and resorting to the sand-dunes to breed, they frequent the beach, sand-shoals, mud-flats, and scant-herbaged salt meadows indifferently, in flocks of considerable size, keeping much among themselves; their size, longer legs, and large black bill render them conspicuous among their congeners; they are rather shyer than the rest, and their note is decidedly different. In those opened were found gravel, insects, soft substances apparently both animal and vegetable, and fragments of small molluscs, particularly the fragile young of the *Solen ensis*.

Some account of their nidification, and a description of the eggs, will be found in the *American Naturalist* for September, 1869. This occasion is taken to repeat that the usual number of eggs is three, not four.

***Squatarola helvetica.***

Abundant during the migration, particularly in October. Here they frequent the water-edges, and the flesh is hardly so good as when they feed over uplands.

***Streptilas interpres.***

Very common during the migration, and some probably winter. In May, just before they leave, very perfect specimens may be procured. They begin to return the last of August, and soon become abundant. Many of the old birds at this time retain much of their spring attire, and are thus readily distinguished from the young.

1871.]

*Gallinago wilsonii*.

Common during the migration, and often in winter; but are somewhat uncertain. They frequent the marsh, &c.; but rarely, if ever, the more open ground about the harbor.

*Macrorhamphus griseus*.

Very abundant during the migration, and perhaps some winter, as they may be taken in December. They occur in large flocks on the sand-bars and mud-flats, as well as on the salt meadows, and afford excellent shooting. They are not so common in the spring, and the passage is more rapid.

*Pelidna americana*.

Very abundant, April and May, and September to November; some may remain all winter. A large part of them attain their perfect dress before leaving in the spring; and it is partly retained by many during the full migration, when, however, most of them are in plain gray plumage. The vernal change begins early in April, soon after the main body arrives from the south. Even in spring they are often found exceedingly fat; and in the fall their corpulence seems only limited by the capacity for expansion of the skin. In examining a great number, I found a variation of a third of an inch in the length of the bill; but this is always considerably over an inch long, and never quite straight. They seem to prefer muddy flats to the beach, and are among the most snipe-like of the sandpipers.

*Aotodromas bonapartei*.

Common, during the migration, associating in flocks with several other species. The larger size, and conspicuously white rump, mark it at once from *Ereunetes*, and the next species. its most frequent companions.

the beach and marsh are cleared of all their sandpipers about the first of June; and, for some six weeks, scarcely a straggler of the sort is to be seen. But about the middle of July—a few before or after the 15th—a few of this and the next species appear, and in August the numbers are materially increased, in advance of the main body of September arrivals. It is in question about these July birds. It seems improbable they should have gone so far north as the most southern where we know of their breeding, and have raised a brood, in short six weeks of their disappearance. Probably they are those that left in the van of the spring migration, or those that did not accomplish a complete migration, from whatever

*as pusillus.*

remely abundant, as elsewhere along the Atlantic coast, in the migrations; here, chiefly from early April to June, from August (see above) through October. They show a decided preference for the beach as the least sandpipers do for the flats.

*arenaria.*

very abundant at all times, excepting during the three summer months. The greater number pass north early in May, but a few until June. Some arrive late in August, and most of them in September. After October they are conspicuous by their light appearing almost white at a distance. The vernal change takes place in April, but the process is slow, and few completely changed birds are seen here. Up to a short time before their departure, they continue in compact flocks; but in May, are more dispersed, and the prospective pairs are seen chasing each other over the sand, the males, puffed up to nearly twice their usual size, going through a variety of odd motions, and piping in exultant tones.<sup>1</sup>

In this bird, with no external trace of a hallux, the accessory metatarsal is absent, without, however, bearing even a rudimentary phalanx, and without any protuberance of the metatarsal envelope. It is a small oval or reniform ossicle, slightly twisted on itself, and deeply sulcate in the middle, lying in the fossa between the three prongs of the metatarsus where it is ligamentously bound down. It lacks the usual roughened surface of opposition with the principal bone. Independently of morpholo-

***Symphesia semipalmata.***

Resident, but less common during the colder months; very abundant at other times, and one of the few waders that regularly breed here. Numbers arrive from the south in March and April; a part of them proceed further north, and the rest, in May, scatter over the marshes to breed. In August the ranks are again recruited by the numbers hatched here, and in September by others returning. The large size, variegated color, and restless, noisy disposition combine to render it one of the most notable birds of the vicinity in summer.

***Gambetta melanoleuca.******Gambetta flavipes.***

Both common during the migration—the first named the more abundant.

***Rhyacophilus solitarius.***

Only observed in April and May, and September and October, and not abundant.

***Tringoides macularius.***

Summer resident, arriving late in March, becoming very abundant in April, and the greater number passing north in May; but the young are common in July.

***Limosa fedoa.***

Abundant during the migrations, particularly in the fall. Possibly some may breed in the vicinity, but I am not sure of this.

March. Some flocks that I witnessed must have contained thousands of birds. These were not the species just named, but whether *hudsonicus* or *borealis* was not ascertained.

***Recurvirostra americana.***

I scarcely think that this is a regular, and it certainly is not, according to my observations, a common migrant here. The only time I identified it with certainty, was on the 12th of September, when a flock of six was seen.

***Ardea herodias.***

A resident species, common on the marshes at all seasons. This and the Bittern are the only species of the family that I observed in winter. I do not know that it breeds in the immediate vicinity, but such is probably the case.

***Herodias egretta.***

Only observed late in summer, and through autumn, when moderately common, and generally seen in small flocks.

***Garzetta candidissima.***

Apparently a summer resident, though not observed breeding. I first saw it early in May, when it appeared to be migrating, but individuals were obtained at various times during the summer. They were oftenest in flocks of considerable size. Old birds killed in July still had lengthened plumes on the head and breast, but the former were not recurved, and the dorsal ones were wanting. Except in these respects, the birds of the year were like the adults. They remain until October at least, and probably later.

***Butorides virescens.***

Summer resident, and very abundant, arriving late in March and early in April, and remaining until October. They breed in colonies with the jackdaws, placing the nests in the thick shrubbery that covers part of this end of the island. The nests are rather large and frail platforms of loosely interlaced twigs, built on dense beds of small branches, or saddled in a crotch, or swung like hammocks upon a mass of climbing vines. The birds begin to lay the second or third week in April, but some do not fill the nest until after the first of May. The complement is usually five or six; but I have found only four, and in one instance *seven*—the latter number probably being the maximum. The old birds

1871.]

shed their dorsal plumes during the period of incubation; the young, for some time after quitting the nest, show traces of down here and there, particularly about the head.

***Botaurus lentiginosus.***

I think that the Bittern will prove a resident species here, though I have only observed it from September to May. It is quite common in the fall; thus, I have shot two or three, and seen as many more in an afternoon's walk in October. Singular as it may seem, viewing the abundance of the bird, and its wide distribution over North America, a complete history has not yet appeared. The earlier accounts are defective, and not entirely accurate. Perhaps the best notice we have is Mr. Endicott's, in the *American Naturalist*, iii, p. 169.

***Ballus crepitans.* (= *R. longirostris*, Bodd.)**

This is probably the most abundant, and it is certainly one of the most characteristic birds of the locality. It should properly be classed among the resident species, although its numbers are greatly diminished during December to February, and it may entirely disappear in very cold weather. Its ranks are largely recruited in March, and little or no decrease is perceptible until November. It becomes very noisy in April, and the marshes resound with its harsh cries until the next autumn. The laying season is at its height during the latter part of April, and through a portion of May; but eggs may be procured nearly all summer. A full account of its nidification, with other particulars, will be

*Perna carolina.*

During the migration only, in April, May, and part of August to October; then common.

*P. noveboracensis.*

One individual observed April 12th, under circumstances that left no doubt of the identification.

The numbers of wild-fowl that throng the sinuosities of the coast in winter are simply incalculable. Immense flocks cover the waters of the harbor; and yet these are said to be inconsiderable compared with those upon the land-bound reaches of water a little removed from the coast. Aside from the natural conditions determining this influx of the Anatidæ, such as congenial latitude, convenient feeding-grounds, and an abundant supply of food, we may attribute a part of the number of water-fowl to the incessant and systematic persecution they suffer somewhat further north. Here they are comparatively free from annoyance, their destruction not being attempted methodically, nor usually with any considerable degree of skill. A few of the species appear in the early fall, but the great flight does not fairly set in until the cold weather of November. The numbers are full the following month, and continue undiminished through the winter. The decrease is

disappear soon, by fusion of the two branches on the upper half of the neck behind. The pt. humeralis is completely isolated by apteriæ from surrounding tracts; it is short but wide and strong, and lies parallel with the spinal. The pt. femoralis is doubled; an inner and outer row of feathers are entirely separate, and both of them are strong. The under or upper band arises over the extremity of the pelvis, and runs with slight obliquity to the front of the knee; the outer arises from the side of the coccyx, and runs parallel with the other along the lower edge of the outer aspect of the thigh to the crus; it is there almost continuous with the ventral tract, and is but slightly separated at its origin from the caudalis; but is as widely separated from the other femoral tract as this last is from the spinal. The pt. cruris is as yet only indicated by a few sparsely distributed follicles, with the feathers beginning to protrude along the anterior and posterior borders; the pt. alaris is in the same condition, and the caudalis but little more advanced. The ventral pteryla is double throughout; its branches are separated from each other on the neck, by as much space as they are from the spinal tract; and rather abruptly divaricate on the breast, inclosing a broad oval space, finally approaching gradually as they pass backward. The anal circlet of feathers is just perceptible, but that around the oil-gland is not visible.

1871.]

very great in March, and few are found later. I do not know that more than one species is resident.

*Bernicla canadensis.*

A few geese may come in October, but they are not plenty for a month subsequently. Some are to be seen in April, but the greater number depart in March. I think that occasionally a pair may remain to breed in the vicinity, as I have seen a brood in domestication, said to have been raised from the egg; a statement that bears weight from the impossibility of procuring young birds in any other way. But such instances are doubtless exceptional. Geese may be procured, in season, for a dollar, or even less, apiece; a fact of itself attesting their abundance.

*Bernicla brenta.*

Common in winter, and seen until April 6. This and the last were the only geese observed; nor did I ever hear the gunners allude to any white ones, though I should judge that *A. hyperboreus* would also occur in winter.

*Anas boschas.*

Very common.

*Anas obscura.*

Common.

*Dafila acuta.*

Common. Among the earlier October arrivals.

*Chaulelasmus streperus.*

Common.

*Bucephala americana*. (= *B. clangula*?)

*Bucephala albeola*.

*Fulix marila*.

*Fulix affinis*.

*Aythya americana*.

Of these the two last named are apparently the most abundant. The canvas-back I have never seen here.

*Colinus perspicillata*.

Very common. Early in November, 1870, before the complement of general wild-fowl was made up, these were perhaps the most abundant ducks on the harbor, mixed with a number of the next species. By far the larger proportion were females and young. The young males at this season almost exactly resemble the females; having the two whitish spots on each side of the head, and bill wholly black, the place of the future black spot in the bill being indicated by a slight corrugation of the skin. But they are generally distinguishable by the presence of a few perfectly black feathers about the head, and by the rather more turgid bill.

*Colinus americana*.

Common. The female and young are distinguished from those of the last by the different number of tail-feathers, different shape of bill, and the continuously whitish sides of the head; otherwise the resemblance is very close. Both are known as "black ducks," and by a probable further confounding with *A. obscura*, are pronounced good eating by those who do not intend to eat them.

*Mergus serrator*.

Very abundant. I should judge this to be the most numerous of all the family in this vicinity. They are always on the harbor from October to April, and a few both earlier and later; and are not much molested, being unacceptable even to not over-fastidious people. The distribution of their colors, showing large pure white areas, marks them out at any distance; the *Bucephalæ* being the only ducks to which they bear any special resemblance.

*Pelecanus fuscus*.

A few observed at irregular intervals through the summer months.

1871.]

*Sula bassana.*

Several were seen during foul weather, in February and March, both years; but the species is not a common, if indeed a regular, winter visitor.

*Graculus floridanus.*

Cormorants may be seen at intervals the whole year, and are common except during the warmer months. There are two species; but I did not succeed in ascertaining their times of arrival and departure. The summer birds are all, without doubt, the *G. floridanus*, to which species a full-plumaged specimen, captured in the spring of 1869, belonged; and the winter ones are in all probability

*Graculus dilophus.*

Very common in winter. Judging from the light brown appearance of most individuals observed at this season, they were chiefly young birds.

*Puffinus fuliginosus.*

A specimen taken May 21, 1870, in fine plumage, but injured in one of the webs; this disability probably accounting for its exceptional occurrence. It was caught by hand near the shore, and kept alive for some time. Placed on a level surface, it could with difficulty stand upright, and on endeavoring to walk, sprawled with the use of its wings and by hooking itself along with the sharp point of the bill—not, however, grasping with both mandibles. I was before ignorant of this method of assisting locomotion on land, but can readily believe it to be a habit of

**Larus smithsonianus.**

Winter resident; very abundant; the characteristic and only common bird of the family throughout that season. I have been repeatedly assured that some of the "sea-gulls," as this species is called in distinction from the smaller kinds, remain all summer, but have never seen any at that season, and doubt the statement, except perhaps in its application to diseased or otherwise disabled individuals. Some, however, certainly linger longer in spring than would have been anticipated, being seen almost until June. There is little falling off in their numbers in March; but most of them pass northward early in April, about the time that the Terns and *Chroæcocephali* make their appearance. A few arrive in September, but they are not plentiful until the latter part of October. In consequence of being rarely molested, they become quite familiar, often mixing with the tame geese about the fort, and permitting themselves to be approached within a few feet; still, as a rule, they show that they have an excellent idea of gunshot range. Three styles of these gulls are easily distinguished. The birds of the year are smoky-brown (becoming grayer towards spring), and differ in this respect from the young of any other species occurring here. The birds hatched the previous summer but one are pale grayish, with the blue of the mantle showing in irregular patches, the primaries wholly black, and the rectrices either the same or white with a terminal black bar. The birds in their third year are in perfect plumage, but show the dusky streaking of the head and hind neck characteristic of the winter plumage. The bills of the birds of the first class are black; of the second, flesh-color, black-tipped; of the third, yellow, with or without the orange spot at the angle of the gonys. Most of the old birds regain their nuptial dress before leaving. They are rather silent during the winter, being rarely heard except when quarrelling for food; but in April, before they move off, the air resounds with their hoarse cries. Among the substances found in the stomach were the remains of a marsh-hare, though I hardly think that the animal could have been captured alive.

**L. delawarensis.**

Spring and fall; common, and *probably* also a winter resident, although I did not identify it at that season.<sup>1</sup>

<sup>1</sup> In winter the head and hind neck of this species are definitely *spotted* with blackish. In the case of the last species, and of, probably, the whole 1871.]

*Chrococephalus atricilla.*

Extremely abundant, in spring and fall. They appear the last of March or early in April, and become plentiful during the latter month. They remain so late, and are absent so short a time during the summer, that I think some breed near by, though I found none actually nesting in the vicinity. Probably only two years, instead of three, as in the case of the larger *Lari*, are required for them to assume the perfect plumage. The majority of the spring birds are in full attire, but among them a large number of the conspicuously brown birds of the preceding year are always seen. A few return in August, many more in September, and by the last of this month their number defies computation. It is no exaggeration to say that I have seen a thousand rise at the same moment from a single sand-bar where they were resting and pluming themselves after feeding. They fish in companies often of numbers but little inferior, following the shoals of small fry about the harbor, continually descending upon them, and rising on wing again after a moment's half-submergence. At such times they are in pursuit of the small fish that form the principal food of the blue-fish, and their presence is an unfailing guide. At this season the brown birds greatly outnumber the others. The adults are mostly moulting when they return, and retain traces of the spring plumage—seen in a slight glow of the under plumage, carmine tint in the dusky of the bill, red mouth, and slate about the head—at least until October, when the renewal is completed. The young of the year are quite definitely brown,

off in November, and few are seen after this month. I am not sure that *any* remain all winter.

***Chrococephalus philadelphia.***

Extremely abundant, but only in spring and fall, being strictly migrants here. They appear about the first week in April with the last species, generally remain through most of May, and return in September, remaining until the end of November. But this general statement may be somewhat qualified in detail by some observations that have interesting bearing, unless I wrongly interpret them. In 1869, from the beginning of April until the 22d, the birds were here in great numbers, and with a marked preponderance of old full-plumaged individuals. Without any change in the weather, or other assignable cause, they suddenly disappeared, presumably having moved northward. For a week or ten days scarcely one was to be seen; when they became more numerous, if possible, than before, and so continued through the greater part of May. This last lot was almost entirely composed of birds of the previous year, as shown by the plumage, there being hardly a black-headed one among them. I should judge, therefore, that the old birds migrate in advance of the young, and also that they move the more hurriedly of the two. It is probable, moreover, that only these adults were going to breed that year, although it is pretty certain that some gulls, at least, reproduce before gaining their perfect plumage. In the fall few black-headed ones are ever seen, the hood being lost before they reach this latitude; but even at this season the old and young are readily distinguished by other marks. Many return in September, and then the earliest ones to come are the young. I verified the same general observations through four migrations that I witnessed. This year (1870) there were few—almost no—birds in part of October, after the September young appeared to have passed on; but as I write (Nov. 18) the harbor is covered with thousands of old ones in their winter dress. They appear at a little distance almost pure white, and are beautifully conspicuous among the other gulls and the terns with which they associate.

Audubon is certainly mistaken in representing the female of this species with a brown hood. The sexes are not distinguishable by any outward marks. If there is a United States gull with the head of the color shown in the plate just alluded to, it must  
1871.]

being in a position that the subject of the latter could be  
seen.

#### *Thalassidroma*

This was certainly breeds somewhere in the vicinity: for, although I did not find any nests, I saw it constantly through two summers, and occasionally noticed birds so young that they were still receiving attention from their parents: while in June and July small flocks were often noticed pursuing so straight a course for long distances, that I had no doubt they were passing directly between their nests and their feeding-places. It commonly arrives from the south early in April and through this and the next month is more abundant than at other times until the fall—a part, I presume, passing farther north. It becomes numerous again in September, and so continues until the end of November. I cannot say whether or not any remain all winter, but think that, if observed at that season, it will be an exceptional case. It is more wary than any of the other terns, and is always the first to rise among the miscellaneous troops that flock the sand-bars. It is conspicuous by its size and bright red bill: and the young are easily distinguished by the smaller size, yellow instead of red bill, and spotted plumage. The old birds lose the black pileum in September, the crown then becoming white, bordered behind by the long, loose blackish feathers of the occiput, and a few other dark ones on the sides of the head. The bill in winter is not so vivid in color as in summer, and much shorter.

A few others of the same family were also seen, but the subject

in September (a few probably somewhat earlier), and is very common until December. A large number shot in the middle of September were in the same condition of plumage as *T. regius* was at the same time. The species may be marked out among its allies by its size, its singularly trim shape, conspicuously black, *long* bill, yellow-pointed, and a general *whiteness*; the mantle being paler than in any of the others. Specimens, even in the fall, frequently show a rosy blush of the under plumage, much like that generally supposed to characterize *T. elegans* of the California coast.

The difference in the pattern of the coloration of the primaries of this bird, that was noted in my "Review" as separating the species (or whatever it is to be considered) from the European *T. cantiacus*, has not failed in a single instance that has come to my knowledge. No reliance, however, can be placed upon the yellow tip of the bill as a character; this varies from *nothing* (in immature specimens) up to a third, or nearly, of the total length of the bill, and no two specimens show exactly the same line of demarcation between the yellow and the black. Specimens, as usual in this family, differ much in size, and particularly in the length and stoutness of the bill. The feet are always black, as in *T. regius*.

***Sterna hirundo.***

Very common, but only during the migration. Arriving from the south early in April, they all pass on during the following month. They are abundant again in September and October, perhaps a little earlier and later, but I identified none except during these months. In the spring they are scarcely to be told with certainty, unless shot; but in the fall they are conspicuous by the fact that they retain the black pileum, at least as long as they remain here. It has been stated, upon eminent authority, that this species never loses the black on the head; and, although I do not confirm this from examination of specimens taken in the depth of winter, my observations until the end of October support it, and I do not remember to have seen in any museum a Wilson's tern without the feature in question. Numbers shot here in September had completed the winter plumage, and were newly feathered, except on the crown, where the black looked worn and faded, but was still unmixed with white, except a few specks on the extreme front. I presume that the change on this part of 1871.]

the body is very gradual. At this season the feet were simply orange-yellow, not vermilion, and the bill was dusky-shaded throughout. Some of the year's young had nearly perfect wing and tail feathers; but the mantle showed dusky mottling, with some blackish areas upon the wing-coverts; while younger still were marbled and otherwise beautifully variegated with gray, light brown, &c. In all the young, the feet were yellowish, more or less obscured; and the bill mostly black, with yellow or orange on the basal part of the under mandible; it was smaller than that of the old, not so horny, and more obtuse.

**Sterna Forsteri.**

Chiefly migrant, but also winter resident. Compared with the last, there is, I think, a difference in the migrations, &c., something like that I have endeavored to show in the case of the *Ammodromi*, this being the more northerly species of the two, migrating earlier in the spring and later in the fall, and wintering where *S. Wilsoni* does not; of the breeding I can say nothing from personal observation. A few Forster's terns come back in August; they become abundant the following month, and there is little or no decrease of their numbers until December, when a part go further south, to return the latter part of March, and the rest remain. It is one of the most plentiful terns on the harbor in October and November, when it may be distinguished at any reasonable distance with ease; Wilson's tern being the only one at all resembling it, and this being marked in the manner just indicated. Forster's at this

through the eyes to and over the auriculars. The blue mantle only partly appears at this time, being lightly washed over with gray and clear brown; the rectrices are heavily dusky, as in *hirundo* at the same season, but the dark color is on opposite webs in the two species. The wing-feathers are new and perfect, and more hoary-silvery than those of *hirundo* of the same age; but the pattern of coloration is exactly duplicated. The feet are yellow, more or less obscured with dusky.

***Sterna antillarum.***

Summer resident, from early in April until October; and, except at the height of the influx of the other kinds, the most abundant tern of all. It breeds here in great numbers. Referring again to an article in the American Naturalist for September, 1869, for an account of its nidification, I have only to add here—

A tern shot May 17, had then an egg ready to be laid; but most of the eggs are deposited towards June, and during the fore part of that month. The first young birds I noticed were flying June 20th; but this was early for them, the broods not being fairly on wing until the middle of July. During all of May and June, indeed, there are plenty of immature birds about; but these, it should be observed, are of the last summer's broods, rendering the conclusion obvious that at least two years are required to assume the perfect dress. These birds have the bill black, no black cap or white crescent, slaty auriculars and occiput, dark bar along the front edge of the wing, imperfectly colored primaries, and slightly forked tail; thus not possibly to be confounded with birds of the season, which are curiously variegated with gray-brown, and white, and show no pearly blue. The yearlings were in plenty with the adults at the breeding-grounds; but whether or not they were paired and had eggs too, was plainly impossible to determine, as terns' eggs are almost never identified as to the exact parent, when numbers of the birds are breeding together. The usual number of eggs, I may repeat, is two, not three, and often only one is laid; they do not average over  $1\frac{1}{4} \times 1$  inch. The black tip of the bill of this species varies from *nothing* to a fourth of the length of the bill. The distinctions between the species and *S. minuta* are constant and perfectly satisfactory.

***Hydrochelidon fasciata*.**

Migrant only; very abundant. This tern differs somewhat from the rest, in its times of migrating and other particulars. It is not very common, comparatively, in spring, and passes north swiftly and silently. The first spring I saw none until May 15th, and had begun to think that I had missed them, or that they were migrating inland, when they became plenty, but only for a week or ten days. All that I saw were in perfect spring dress. They return in the van of all the terns, about the second week in August, when many are still black, but by far the greater number in the plumage of the young. They remain until October—not later, I think—and during September are as common as any of the others. Although they flock with the rest over the harbor, and on its sand-bars, they also frequent the marsh, where they flutter about for hours, busy catching insects—chiefly grasshoppers, I think—in a manner that reminds one of night-hawks similarly engaged; and, in fact, the two birds are frequently associated together at such times.

***Haliplana fuliginosa*.**

Concerning this species I can offer nothing beyond the record of the appearance of a flock March 16, 1869, during a southwest gale. I have seen none since, and can as little account for this as for their isolated appearance on that occasion. If, as is most probable, the gull-billed, arctic and roseate terns pass this point, they escaped me altogether.

The young in the fall are curiously variegated with dusky and whitish above—few specimens being exactly alike. The note of this species is instantly distinguished from that of any of our other species of this family by its deep guttural intonation, more like the croaking of some herons than the cries of the gulls and terns. The bird also differs from its allies in going in true flocks, as distinguished from the gatherings, however large, in community of interest, that occur with the gulls and terns. The birds move synchronously, which is not the case with any of the others. They feed chiefly by night, or at any rate in the dusk of evening, at which time, in passing over the harbor, one may hear their hoarse notes on every hand, and see the birds gliding swiftly along just over the water, either singly or in small flocks. During the day-time, when the gulls and terns are busy fishing, the skimmers are generally seen reposing on the sand-bars, and they never drop on their prey like their allies. Their mode of feeding is not exactly made out, but it is believed they skim over the surface with the body inclined downward, the bill open, and the under mandible in the water, so that they really take their prey in a manner analogous to the feeding of whales.

***Colymbus torquatus.***

Abundant winter resident, from the latter part of September until May. The greater part, however, do not arrive until some time in October, and a few linger through a portion of May. I took one full-plumaged bird alive in the latter part of June; but it had evidently been prevented from migrating by sickness, and died shortly afterward.

***Podiceps cristatus.***

Occasional, in winter. (Specimen, January 29, 1870.)

***Podilymbus podiceps.***

Frequent, in winter.

### III. REPTILES.

I am indebted to my friend Mr. J. A. Allen, of Cambridge, Mass., for identification of some of the specimens.

#### SAURIA.

***Cnemidophorus sexlineatus*, D. & B.**

Very abundant on the islands and sandy parts of the adjoining mainland. They appear usually early in April, and may be 1871.]

found until cold weather in October. In spite of their remarkable agility, they are one of the animals oftenest found in the stomach of the larger snakes.

*Alligator mississippiensis.*

Of common and regular occurrence in the swamps of the adjoining land, and *said* also to occur in the woody, marshy part of the island.

*Ophisaurus ventralis*, Daud.

One of the most abundant and characteristic reptiles of the island. The first examples noticed each year were taken the third week in March, and this is probably the usual time of their appearance. Like the smaller lizard, they are out until the cold weather of October. They avoid the wetter parts of the island, and are especially numerous in open grassy places, as about the fort, where they may be almost daily taken during the summer. They appear rather inactive, if not sluggish, make little or no resistance when captured, and readily become tame. With an average length of a foot and a half, specimens were taken ranging from a few inches to nearly a yard; and the tints vary greatly, the variation being apparently a matter of individual peculiarity.

OPHIDIA.

*Candisena horrida* (Linn.), Cope, Pr. A. N. S. Philada. 1859, 338, and Smiths. Cont., Jan. 1861, 122.

Common in the vicinity, and certainly occurring on the islands

ance of being obliquely banded, without perfect distinction of the black hexagons along the back.

**Bascanion constrictor**, B. & G.

Very common.

**Lepotophis æstivus**, Holbr.

Of frequent occurrence, particularly in thick bushy places.

#### TESTUDINATA.

**Malacoclemys palustris**, Ag.

Very abundant.

**Chelonia midas**, Schw.

Common.

Besides the foregoing, three other species, not determined, were noticed, one of which is called "chicken-turtle," and another is a *Cistudo*.

---

No species of batrachian was noticed on the island during my residence. On the mainland, and also on Shackleford, two species of *Rana* (undetermined), and a *Hyla*, were observed. The toad (*B. lentiginosus* = *B. americanus*?) is very abundant on the mainland. Great numbers were observed in the ditches, March 27, 1869, and within a few days of the same time the following year, copulating and very clamorous. Probably, then, this is their usual time of spawning.

(To be continued.)

FEBRUARY 6.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-one members present.

PROF. LEIDY stated that he had recently received a small collection of fossils for examination from Prof. J. D. Whitney, who obtained them from California. The specimens are as follows:—

A fragment of an inferior molar, apparently of *Mastodon americanus*. Of this specimen Prof. Whitney remarks that it was obtained from a depth of 80 feet beneath the basaltic lava of Table Mountain, Tuolumne County, Cal., where it was found in association with remains of human art.

A much worn lower molar of a large horse, probably the *Equus pacificus*. From 16 feet on Gorden Gulch. The triturating surface of the crown measures  $13\frac{1}{2}$  lines fore and aft, and 10 lines transversely, inclusive of the cementum.

Two equine molar teeth, which, according to the accompanying label, were obtained 350 feet below the surface, at Soulsbyville, Tuolumne County, Cal. One is an unworn upper back molar, apparently of a species of *Protohippus*. It is moderately curved from behind forward and downward, but only slightly from within outward. It is 21 lines long in a straight line. Its greatest breadth above the middle, fore and aft, is nearly 9 lines; its thickness, about 7 lines.

The other tooth is a lower molar, about one-third worn, probably of the same species. The triturating surface is 10 lines fore and aft, and nearly 7 transversely.

Two teeth labelled "Found 10 feet below the surface at Dry Creek, near Bear Creek, Mercer County, Cal." One of the speci-



FEBRUARY 21.

Mr. VAUX, Vice-President, in the chair.

Nineteen members present.

---

FEBRUARY 28.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-one members present.

The following were elected members:—

Caleb Cresson, J. B. White, M.D., William. P. Jenks, Henry T. Peck, Archibald McIntyre, John McLaughlin, Lewis Thompson, George Thompson, Rachel L. Bodley, Lieut. Clarence E. Dutton, S. J. W. Mintzer, M.D., Elizabeth Shreve, Charles C. Phillips, Richard Morris Smith, S. Warren O'Neil, Charles T. Yerkes, Jr.

S. B. Buckley was elected a correspondent.

On favorable report of the committee, a paper "On Certain Species of Falconidæ, Tetraonidæ, and Anatidæ," by Prof. A. Newton, was ordered to be printed.

---

MARCH 7.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-nine members present.

The following paper was presented for publication:—

"Descriptions of new species of Invertebrate fossils from the Carboniferous and Devonian Rocks of Ohio." By F. B. Meek.

The death of Dr. Charles M. Wetherill was reported.

MR. THOMAS MEEHAN referred to some observations he made before the Academy last autumn in regard to a peculiar storing up of turpentine in the common insect, *Reduvius novenarius*. Since then entomologists had been investigating the use for which this turpentine was employed, without success. He was now able to report that it was for the purpose of fastening its eggs on the branches of trees, and for sticking them together. Also, in probability, as a means of protection against enemies and the weather. The eggs of the *Reduvius* were inserted in groups, and each set upright one against another with the turpentine, like the cell in a 1871.]

honeycomb. It had hitherto been supposed by entomologists that the matter used for this purpose was a secretion of the insect itself; but so far as he could judge by the senses, the matter used was merely turpentine, and no doubt the turpentine he had observed the insect storing up in the fall.

MR. MEEHAN exhibited some flowers of the common *Bouvardia leiantha* of the green-houses, and of the hardy *Deutzia gracilis*, and referred to his papers, published a few years ago in the Proceedings of the Academy, on practical diocism in the trailing *Arbutus* (*Epigæa repens*) and *Mitchella repens*, in which he pointed out that these plants, though apparently hermaphrodite, had the stamens and pistils of different characters in separate plants, and were, therefore, subject to the laws of cross-fertilization as indicated by Darwin. He had had his attention called to the *Bouvardia*, by Mr. Tatnall, of Wilmington, Del., as furnishing a similar instance to that of *Epigæa* and *Mitchella*, to the same natural order as which the *Cinchoneous* division of *Rubiaceæ* the *Bouvardia* belonged. These had some plants with the pistils exerted, while in others only the stamens were visible at the mouth of the corolla tube. Mr. Tatnall had not had the matter suggested to him early enough to say that it was so in all cases; but he believed that these flowers, which practically might be termed pistillate and staminate, were found entirely on separate plants. This is a very important fact, as the *Bouvardia* is not raised from seeds in green-houses, but from cuttings of the roots, and, therefore, all these plants with separate sexes must have been produced from one original individual, without the intervention of seed, and thus confirm the position advanced in a previous paper of the speaker on "Bird variations," namely, that variations in form, and, by logical inference, new species, may arise without selected intervention, and that in this way selected species may

In the case of the *Bouvardia* a similar law was seen. The most vigorous stems, or, as they would technically be called, woody axes, produced the female flowers.

PROF. COPE made some observations on a Batrachian of the coal measures, *Sauropлеura remex*, Cope. A specimen more perfect than the type recently obtained by Prof. Newberry, exhibited posterior limbs such as had been ascribed to the *S. pectinata*. The vertebræ posterior to this point were perfectly preserved, and supported the remarkable processes to the end.

He also stated that the *Oestocephalus amphiuminus* was distinct, and was furnished with branchial arches of branchiæ bones, for the support of external gills.

---

MARCH 14.

The President, Dr. RUSCHENBERGER, in the chair.

Seventy-one members present.

The publication of the proceedings for September, October, November, and December, 1870, was announced.

---

MARCH 21.

Dr. CARSON, Vice-President, in the chair.

Eighteen members present.

PROF. LEIDY made the following remarks on *Tænia mediocanellata*. Recently, one of our ablest and most respected practitioners of medicine submitted to my examination a tapeworm which had been discharged from a young man, after the use of the *Aspidium filix-mas*. The physician, in giving an account of the case, stated that he had previously treated the patient for another affection, in which raw-beef sandwiches had been prescribed for food. After looking at the worm, I remarked that it appeared to be the *Tænia mediocanellata*, a species which I had not before seen, and added that the patient had probably become infected from a larva swallowed with the raw-beef sandwiches. The specimen consisted of the greater part of the worm, broken into several pieces. Including some lost portions, it was estimated to have been upwards of thirty feet in length. Unfortunately, the head proved to be absent; but, so far as characters could be obtained from the specimen, in the form of the segments, position of the genital orifices, and the condition of the ovaries, it agreed with the description given of *T. mediocanellata*, rather than with

1871.]

*T. solium*. From a want of acquaintance with the former, I did not feel entirely satisfied that the specimen actually belonged to that species.

Subsequently, my friend brought to me the anterior part of the body, probably, of the same individual tapeworm. He observed that his patient continuing to complain, he had administered another dose of the male-fern, which was followed by the expulsion of the portion of the worm now presented. The head of the parasite was included, and it confirmed the view that it pertained to the *Tænia mediocanellata*.

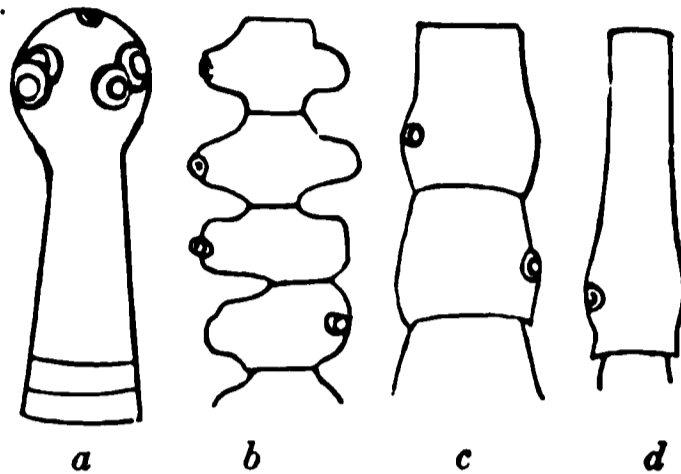
The case serves as another caution against the use of raw flesh as food.

The description of the worm, as derived from the specimen, is as follows:—

The head is white, without pigment-granules, obtusely rounded, unarmed with hooks, and unprovided with a rostellum, but furnished with a minute acetabuliform fovea at the summit. The four acetabula are spherical, and opaque white. The diameter of the head is three-fourths of a line. The neck, or unsegmented portion of the body immediately succeeding the head, is about 4 lines long by half a line in breadth. The most anterior indistinctly defined segments of the body, and those immediately succeeding them, but more distinctly separated, are about one-fifth of a line long by two-fifths of a line broad. In a more posterior fragment of the body, the flat and nearly square segments measure half a line long and 1 line broad, to one-third line long and  $2\frac{1}{2}$  lines broad. A succeeding fragment exhibits segments  $3\frac{1}{2}$  lines long by 4 lines broad, and 2 lines long by 5 lines broad. Many of the segments in this piece are irregularly separated, laterally, by deep, wide notches. In a succeeding long portion of the worm, the segments are wider behind than in front, and measure

pit or fovea at the summit of the head is not mentioned by Küchenmeister and subsequent observers as a character of that species. It is a point, however, that might be readily overlooked, especially if the parts of the head are obscured by the presence of pigment-granules.

Fig. 1.



*a.* Head and neck magnified. *b.* Form of segments in an anterior fragment of the worm. *c.* Form of segments in an intermediate fragment of the body. *d.* Form of segments at the posterior part of the worm.

PROF. COPE exhibited a number of fishes from the Amazon above the mouth of the Rio Negro, which included some new and rare forms. Some of the latter were *Doras brachiatus*, *Plecostomus scopularius*, *Roeboides rubrivertex*, *Myletes albiscopus*, etc. The *Plecostomus* has the following characters: D. I. 7; A. 5; L. l. 27; head 25, total length; eye 25, interorbital width. Interapercular bristles very short, acute. Dorsal fin longer than high; eight scuta between the first and second dorsals. Length, two feet. Color, light brown, with very numerous closely placed brown spots, those on the head more closely placed and often vermiform. Dorsal fin spotted. Long bristles on front and outer surfaces of both pectoral and caudal supporting rays, which are hooked at the end. Caudal marginal radii subequal. No ridge in front of orbit; a short, prominent supra-occipital crest.

He exhibited a specimen of *Pariodon microps*, Kner, describing the parasitic habits of *Stegophilus* and those ascribed to *Vandellia*. He thought the structure and coloration of the *Pariodon* indicated similar habits, and that it would be found to be an inhabitant, at times at least, of the cavity of the body of some other animal.

---

MARCH 28.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-three members present.

MR. JOSEPH WHARTON remarked that a letter, received this day, from Thomas Macfarlane, the discoverer of Silver Islet, in Lake 1871.]

Superior, near the north shore, states that, up to March 2, ores to the value of \$250,000 had been taken out, and it is confidently believed that this will be increased before the opening of navigation to \$500,000. A coffer-dam has been built around the islet, at a cost of \$60,000, to increase the area for working. The ore has thus far been sent to the factory of E. Ballach & Son, Newark, N. J., but works are now about to be built at Wyandotte, near Detroit, for the treatment of it. Although the islet is in Canada, and the discoverer is a Canadian, it was not found possible to interest Canadians in the venture of opening the vein, and this extremely promising deposit is therefore the property of citizens of the United States. The ore is worth about \$1500 per ton.

The death of Mr. J. J. Cohen, a correspondent of the Academy, was announced.

The following gentlemen were elected members: Gustavus A. Nicholls and J. Price Wetherill.

The following were elected correspondents: John Hauxwell, of Pebas, Equador, and Hon. H. Nevill, of Ceylon.

On favorable report of the committee, the following paper was ordered to be published:—

•

**DESCRIPTIONS OF NEW SPECIES OF INVERTEBRATE FOSSILS FROM  
THE CARBONIFEROUS AND DEVONIAN ROCKS OF OHIO.**

BY F. B. MEEK,  
OF THE OHIO STATE GEOLOGICAL SURVEY.<sup>1</sup>

The fossils described in this paper are some of the new forms collected during the progress of the Ohio Geological Survey, now being prosecuted under the direction of Prof. J. S. Newberry, the State Geologist. Illustrations of these and other characteristic fossils from the different formations are in course of preparation, and will be published along with full descriptions of the same in the reports of the Survey.

**ECHINODERMATA.**

**DOLATOCRINUS ORNATUS, Meek.**

Body, including the vault, depressed subglobose, the portion below the arm-bases being a little higher than the vault, with nearly vertical sides above, but rounding under below to the somewhat flattened under side; arm-bases protuberant, mainly in consequence of the rather deep furrows or sinuses of the vault over the interradian areas; vault composed of irregular pieces, each of which projects in the form of a little sharply prominent node or short spine, the largest of which are situated around the nearly central ventral tube, and on the elevations between it and the arm-bases. Base small, a little impressed within the shallow concavity of the under side, and marked by a distinctly indented column-facet, which occupies near three-fourths of its entire breadth, so that only a narrow ring, as it were, of the basal pieces can be seen when the column is attached. First radial pieces comparatively large, extending out nearly horizontally, or only a little arching upward, and with their inner ends curving slightly into the shallow central concavity; all wider than long, and hexagonal, with the upper (outer) side of each longer than any of the others. Second radial pieces about half as large as the

<sup>1</sup> I am under obligations to Prof. Henry for the use of books, rooms, and other facilities at the Smithsonian Institution, while preparing this paper.

first, wider than long, and quadrangular in outline.<sup>1</sup> Third radials about as large as the second, from the curved-up edges of which they rise vertically, wider than long, and pentagonal in form; bearing on each of their superior sloping sides a smaller secondary radial, each of which supports another smaller, more or less cuneiform piece, from which the arms arise; thus making two arms from each ray, unless the number is increased by bifurcations after they become free; arms unknown, but apparently composed, at their origin, of a double series of alternating pieces.

First interrarial pieces, somewhat larger than the first radials, about as wide above the middle as their length, eight or nine sided, with the lower part of each curving under to connect with the first radials, while they curve upward vertically from near or below the middle; each supporting on the upper side a much smaller hexagonal piece, which rises vertically, and usually bears on its short superior lateral edges two smaller pieces connecting with the secondary radials or first arm-pieces, while its short truncated upper side is not surmounted by any succeeding piece, but connects on its inner surface with the vault.

Sutures between all the plates channelled. Surface of body-plates ornamented with raised lines or very small radiating costæ, that cross the sutures parallel to each other at the sides of the plates, but soon become bent about and connected in various ways, so that very few of them extend directly to the middle of any of the plates, the arrangement being such as to produce a kind of vermicular style of ornamentation, especially over all the

racter of the vault-pieces around its base, probably also spiniferous.

Height of body to arm-bases, 0.47 inch; do. to top of vault, 0.60 inch; breadth, 0.95 inch.

This species differs so materially from *D. lacus* and *D. Marshi*, of Lyon, in its ornamentation and other characters, as to render a comparison unnecessary. The only other described species from the same horizon, known to me, *D. lamellosus* (= *Cacabocrinus lamellosus*, Hall, Fifteenth Report of Regents, p. 141), must also differ materially, as it is described as having the body "spreading horizontally to the top of the third radial plates." It also has four arms to each ray, instead of only two, as in our species, which likewise differs in the details of its ornamentation.

It is probably more nearly allied to some of the other species described by Prof. Hall from the Hamilton Group, under Troost's name *Cacabocrinus*, though it seems to differ from them all in details; while the limited vertical range of the species of *Cri-noidea*, renders it extremely improbable that the same species would be found in both the Corniferous and Hamilton groups.

It may be proper to remark here that there is no difference between *Dolatocrinus*, Lyon, and *Cacabocrinus*, Troost. It is true, Mr. Lyon gives five as the number of basal pieces in his genus, but he also stated in a note that it may have only three basals, as he had not seen specimens showing the structure of the base very clearly. Troost's genus, as published from his manuscript, after the date of Mr. Lyon's publication of *Dolatocrinus*, agrees exactly with the characters assigned the latter, excepting in having only three instead of five basal pieces. The species here described, however, is certainly a typical *Dolatocrinus*, and yet shows only three basal pieces.

For the use of the fine specimen affording the above characters, the Survey is under obligations to the Rev. Mr. H. Hertzner, of Columbus, Ohio.

*Locality and position.* Columbus, Ohio. Corniferous division of the Devonian.

**LAMELLIBRANCHIATA.****AVICULOPECTEN CRENISTRIATUS, Mook.**

Shell thin, attaining a moderately large size, plano-convex, with a truncato-suborbicular outline; height and breadth nearly equal; basal margin more or less regularly rounded; posterior margin rounding from the posterior ear into the base, sometimes a little straightened above; anterior side rounded so as to make a shorter curve than the other; hinge less than the breadth of the valves in length, but rather long.

Left valve moderately convex; beak rising a little above the hinge margin, nearly or quite central and not oblique; posterior ear small, with a marginal ridge, flat, without being separated from the swell of the umbo by a sulcus, rather acutely angular at the extremity, and distinctly shorter than the margin below, from which it is separated by a nearly rectangular notch; anterior ear larger, or sometimes nearly as long as the margin below, rather acutely angular at the extremity, convex and separated by a rounded impression from the umbo, defined by a rather deep subangular marginal sinus. Surface ornamented by numerous, very slender, radiating costæ or raised lines, separated by rather wide flat surfaces, in each of which a still smaller line is sometimes intercalated; crossing all of these are smaller regularly arranged, sharply elevated, concentric lines, that seem to form little projections at the points of crossing so as to give a rough

mainly casts with some portions of the surface. It is remarkable in having only a comparatively shallow rounded sinus under the anterior ear of the flat right valve, where it is usually deep and angular in species of this genus; while in the left it is deeper and more angular, though none of the specimens are in a condition to show clearly its exact form. One cast shows a little of the cardinal plate, which is rather coarsely striated longitudinally. None of the specimens of the left valve have the surface well enough preserved to show whether the sharply elevated concentric lines or laminæ are minutely waved as in the other valve, but they probably are so when the surface has not been worn or exfoliated.

I am not acquainted with any described species so nearly allied to this as to render a comparison necessary.

*Locality and position.* Sciotoville, Ohio. Upper part of the Waverley series of the lower Carboniferous.

**AVICULOPECTEN (STREBLOPTERIA ?) HERTZERI, Meek.**

Shell usually under medium size, higher than wide, rather compressed, the right valve being nearly flat, and the left only moderately convex; subovate in general outline (exclusive of the small ears), with a slight backward obliquity caused by the greater prominence of the anterior margin; basal outline semicircular and curved regularly into the rather prominently rounded anterior side; posterior margin less prominent than the anterior, and forming a longer and more gentle curve from the posterior ear into the base. Hinge distinctly shorter than the antero-posterior diameter of the valves; posterior ear in both valves very small, flattened, very obtusely angular, much shorter than the margin below, but well defined from the umbo, and only separated from the margin below by a faint sinuosity; anterior ear of each valve distinctly larger than the posterior, though not as prominent as the anterior margin below, rather strongly compressed or flattened so as to be abruptly distinct from the umbo, and defined by a distinct sinus from the margin below, the sinus being deeper and more angular in the right valve; beaks compressed, scarcely projecting above the cardinal margin, and placed a little behind the middle of the hinge, as well as that of the valves. Surface of both valves elegantly ornamented by numerous, sometimes sharply elevated, nearly equal, very regularly

1871.]

arranged radiating and concentric lines, which are larger and more strongly defined in the anterior ear of the right valve, particularly the radiating markings, which there sometimes assume the character of small costæ, while the concentric markings sometimes project as little lamellæ slightly above the hinge-margin, so as to give it a dented appearance.

Height of one of the largest specimens seen, 1.32 inches; antero-posterior diameter, 1.20 inches; convexity, about 0.18 inch.

I know of no other shell in our rocks that is liable to be confounded with this, its general form and neatly cancellated markings being sufficient to distinguish it. Although I refer it provisionally to *Aviculopecten*, I really do not think it belongs properly to that genus, as restricted to the typical forms. At least it differs from all the characteristic forms of *Aviculopecten*, in having the anterior ear larger than the posterior, as well as in having its beaks placed a little behind the middle of the valves, thus giving the slight backward obliquity mentioned in the description. This latter character seems to approximate it to *Streblopteria* of McCoy, but as we know nothing of its hinge and interior, it is not possible to determine whether it belongs to that group.

The specific name is given in honor of the Rev. H. Hertzner of the Ohio Geological Survey, to whom I am indebted for the use of some fine specimens from his own private collection.

*Locality and position.* Newark, Ohio. Lower Coal-measures.



Report Regents on State Cab., N. H., pl. ii, fig. 12); but its peculiar posterior dorsal sulcus, which gives it so much the appearance of the recent *L. Jamaicensis*, is neither represented in Mr. Conrad's figure, nor mentioned in his description of *L. lirata*.

The identity of these Devonian shells with the existing genus *Lucina* may admit of some doubt, as their hinges and internal characters are not yet well known. The species under consideration, however, has even more exactly the *external* appearance of that genus than several foreign Devonian forms that are generally referred to it. Perhaps they may all be included under one distinct genus, for which the name *Paracyclas*, Hall, may have to be retained.

*Locality and position.* Dublin, Franklin Co., Ohio. Corniferous division of the Devonian.

**'PTILODICTYA (STICTOPORA) GILBERTI, Meek.**

Corallum growing in thin, or much compressed, branching (or perhaps sometimes foliaceous) expansions; branches varying from about half a line to three lines in breadth, with a thickness of near half a line; nonporiferous margins sharp, with striæ well defined, and curving laterally and forward. Pores nearly circular, or slightly oval, and provided, in well-preserved specimens, with raised margins; ranged in about eight to ten longitudinal rows in a branch two and a half lines in breadth, those in adjacent rows regularly alternating so as to produce a quincuncial arrangement; five of them occupy a space of one line, measuring longitudinally, and about six measuring obliquely, the spaces between the pores in the longitudinal direction being usually a little greater than the diameter of the pores themselves; rows of pores separated by a slender, sharply raised longitudinal line. Axis forming about one-third of the thickness of the branches, and having the transverse striæ sometimes very regular, well defined, and regularly arched.


I have not seen enough of any one specimen of this species to show whether or not its branches anastomose, but as they evidently frequently bifurcate, and send off lateral branchlets, it is probable that they do. It seems to be more nearly allied to *Stictopora fenestrata*, of Hall, from the Chazy limestone, in the

<sup>1</sup> This description was accidentally inserted in this place.

arrangement and nearly circular form of its pores, as well as in having a raised longitudinal line between each row of pores, than to any of the known Upper Silurian species. It is a much more robust species, however, with only about the same number of rows of pores, in a branch of twice the breadth of those of that species, while it shows no traces of the transverse bars mentioned in the description of *S. fenestrata*. Its flattened, nonporiferous, and striated margins are also much more strongly developed. Indeed, no traces of this character of the margins are represented in the published figures or mentioned in the description of that species.

Although I am not aware that any published notice of the occurrence of this genus in the Devonian rocks has hitherto appeared, I have little hesitation in referring this species to the group, since it seems to present all the characteristics assigned to the same. In one respect it differs from some of the species described under *Stictopora*. That is, in having the pores a little contracted, and nearly circular at the aperture. In this respect, however, it appears to agree with *S. fenestrata*, the first species described under that genus; and Prof. McCoy has shown that this character occurs in British species of *Ptilodictya*, of Lonsdale, of which it is now generally admitted that *Stictopora*, Hall, is only a synonym, or at most founded on types only subgenerically distinct.

From the same horizon as that from which the above-described species was obtained, but from a different locality (Whitehouse, Lucas Co.), there is in the collection a foliated specimen more than



**CONOCARDIUM OHIOENSE, Meek.**

Shell rather small, longitudinally subovate or subtrigonal, being widest and most convex anteriorly,<sup>1</sup> where the valves are rather distinctly ventricose; posterior side produced and abruptly contracted behind the gibbous anterior region, partly from lateral compression, and partly from the upward and backward slope of the posterior basal margin, which is slightly sinuous near the extremity, and distinctly gaping, the widest part of the hiatus being above; hinge-line straight, or sometimes slightly declining at the posterior extremity; cardinal margins of the valves anchylosed; anterior side short, though not properly truncated, abruptly contracted and a little impressed in front of the umbonal convexity, and apparently provided with a slender projection above (this part broken in the specimens); beaks projecting a little above the cardinal margin, placed in advance of the middle and incurved; umbonal slopes gibbous, broadly rounded, and, like the beaks, slightly inclined backward. Surface (as seen in specimens apparently a little exfoliated) ornamented by simple, somewhat flattened, radiating costæ, about five or six of which, on the gibbous part of each valve, are separated by flattened furrows nearly or quite as wide as the costæ themselves; while on the posterior contracted portion, the costæ are proportionally wider, and separated by merely sharply impressed hair-lines, excepting near the posterior cardinal margin, where these impressed linear furrows are represented by little *raised* lines; costæ on the anterior surface more obscure; fine regular lines, and a few stronger marks of growth, are also seen crossing the costæ parallel to the free margins.

Length of a specimen with the anterior attenuated appendage broken away, 0.64 inch; height, 0.43 inch; convexity, 0.37 inch.

This species belongs to the section of the genus that has the umbonal slopes rounded instead of angular, and the anterior side in front of these slopes not so distinctly truncated or flattened as to impart the peculiar Hemicardium-like appearance so often seen in the genus. These characters at once distinguish it from its associate, *C. trigonale*, Hall, sp.; which is also distin-

<sup>1</sup> I merely follow the most general adopted method of describing the gaping end as the posterior, without being entirely satisfied that this is the correct view.

guished by its remarkable alation extending forward from the angular umbonal slopes.

I have seen no specimens of our shell quite entire at the anterior end, but it is evident that there was a slender projection somewhat like that of *C. aliforme* of Sowerby, though it may not have been so long as in that species.

*Locality and position.* Columbus, Ohio. Corniferous division of the Devonian.

**SOLENOMYA (JANEIA) VETUSTA, Meek.**

Shell of medium size, transversely sub-oblong or narrow sub-elliptic, the length being a little less than twice and a half the height; valves rather convex; anterior or longer side regularly rounded; posterior extremity more narrowly rounded; basal margin nearly or quite straight along the central region, but rounding up at the extremities, the curve being more gradual behind; beaks depressed to a level with the dorsal margin, and placed somewhat behind the middle; dorsal margin a little convex and nearly horizontal in front of the beaks, but rounding regularly into the anterior outline, and behind the beaks, slightly depressed below the horizon of the latter, though without sloping much posteriorly. Surface apparently smooth; interior showing distinct radiating striæ below the middle of the valves, excepting near the extremities. Posterior muscular impression rather narrow, suboval, oblique, placed near the margin, and well defined by a slight oblique ridge along its antero-inferior margin; anterior do. larger and faintly marked.

Phillips, from the Carboniferous. Indeed it might even be referred to *S. biarmica*, with more propriety than a Kansas Coal-measure species that has been so referred by Prof. Geinitz. Compared with the figures of the original Russian example of *S. biarmica*, figured in the Palæont. of Russia and the Ural Mountains, pl. xix. fig. 4 *a* and 4 *b*, our shell is seen to be proportionally somewhat more depressed and longer, with the beaks a little less prominent, and farther removed from the shorter or posterior extremity. Its posterior dorsal slope, even in the internal cast, is also less oblique. In this latter character it is even less like the English and German Permian forms referred to *S. biarmica*.

I have elsewhere (Proceed. Acad. Nat. Sci., April, 1870, p. 44) expressed the opinion that these Palæozoic shells usually referred to *Solenomya*, may yet have to be separated from that genus, and ranged under Prof. King's name *Janeia*, notwithstanding the fact that he subsequently abandoned his genus, under the impression that it is not distinct from *Solenomya*. I still think it probable that this may have to be done.

*Locality and position.* Dublin, Franklin Co., Ohio. Corniferous group, of the Devonian.

#### CLINOPISTHA ANTIQUA, Meek.

Shell very thin, transversely suboval, gibbous, with flanks along the middle near the lower margin, somewhat flattened or slightly concave; more than half as high as long. Anterior or longer side regularly rounded in outline; posterior sloping above from the beaks to the narrowly rounded extremity, which is most prominent below the middle; basal margin straightened or broadly sinuous along the central region, and rather abruptly rounded up at the extremities; beaks depressed nearly or quite to the dorsal outline, and placed about half-way between the middle and posterior extremity; dorsal outline nearly horizontal and parallel to the base, in front of the beaks, but rounding regularly into the anterior margin. Surface merely showing moderately distinct lines of growth, with some obscure traces of radiating striæ when a little worn near the base; these last-mentioned markings being more distinct on the internal cast.

Length, 0.82 inch; height, 0.51 inch; convexity, 0.39 inch.

I have been much surprised, to find among the collections from the Corniferous limestone, a shell agreeing so exactly as this in all 1871.]

its known characters, not evidently merely specific, with the type of the genus *Clinopistha*, which I had previously supposed to be confined to the Coal-measures. It has the same short gibbous form, thinness of substance, posterior position of the beaks and ligament, surface markings, and even the same obscure internal radiating striæ. Indeed, if it were not for its rather more narrowly rounded, and more protuberant, instead of slightly truncated, posterior or shorter end, somewhat less gibbous beaks, and faintly sinuous base and flanks, it would scarcely be possible to distinguish it from the Coal-measure form by any external character, excepting the white chalky texture of the shell merely due to its state of preservation. The valves are a little displaced in the only good specimen I have seen, but the beaks certainly give some evidence of being slightly unequal, that is, of the left one lapping slightly upon the other, as in the typical species from the Coal-measures.

*Locality and position.* Same as last.

**SANGUINOLITES! SANDUSKYENSIS, Meek.**

Shell approaching a longitudinal-oblong or trapezoidal outline, moderately convex, a little more than twice as wide as high, and slightly narrower anteriorly than behind; cardinal margin straight, equalling about three-fifths the entire length; basal margin nearly straight and subparallel to the hinge, or slightly ascending anteriorly along its entire length, and rounding up a little more gradually into the front than behind; posterior extremity com-

were originally referred to that genus is to be regarded as the typical form of the same, and something can be known in regard to the hinge and internal characters of those shells, it seems to me almost impossible to determine what *Sanguinolites* is. I do not agree with those, however, who would make *Allorisma* of King a synonym of Prof. McCoy's genus, though some of the species included by him may belong to *Allorisma*.

*Locality and position.* Same as foregoing.

**SANGUINOLITES? OBLIQUUS, Meek.**

Shell so depressed and elongated as to be nearly three times as long as high, rather distinctly convex, particularly along the posterior umbonal slopes, which are more or less angular from the beaks nearly to the posterior basal extremity; pallial margin very nearly straight along most of its length; anterior end extremely short, and a little sinuous on the upper side just in front of the beaks, the sinuosity being caused by a very small deep lunule, at the lower end of which the margin is a little projecting and subangular in outline, and from this little projection curves obliquely backward into the base; cardinal margin extending back about three-fourths the length of the valves, and inflected so as to form a well-defined, lanceolate escutcheon along its entire length; posterior side narrowed with a long slope above from the end of the hinge to the extremity, which is a little gaping and very narrowly rounded or almost angular below; beaks strongly depressed, very oblique, compressed below the ridges, very nearly terminal, and with the immediate points incurved over the little lunule. Surface showing only lines and furrows of growth, with occasional small, obscure, concentric wrinkles, that are not regularly arranged.

Length, 2.13 inches; height, 0.77 inch; convexity, 0.70 inch.

This species seems to be nearly related to a form from the same rock at Medina, Ohio, specimens of which were loaned by Dr. Newberry to Prof. Hall, some time back, and returned with the name *Sanguinolites æolus* attached. A careful comparison, however, of good specimens of each, shows them to be clearly distinct; the form under consideration being much more convex along the umbonal slopes, which are also more angular. Its beaks likewise differ in being decidedly more nearly terminal, and the inflection of its cardinal margin wider. The specimens of *S. æolus* also 1871.]

show faint traces of two or three very obscure longitudinal ridges above the umbonal angle of each valve, and impressions in each of a slight ridge behind the anterior muscular impression, that are not seen in our shell.

From the little that is now known of the shell that will probably have to be regarded as the type of the genus *Sanguinolites*, it is impossible to determine whether or not such shells as this can be properly referred to that genus. They seem to agree, however, more nearly with the same than they do with the typical forms of *Allorisma*, to which they are also related.

*Locality and position.* Rushville, and Newark, Ohio. Upper part of the Waverley group, of the lower Carboniferous.

**ALLORISMA (SEDGWICKIA?) PLEUROPISTHA, Meek.**

Shell depressed and elongated, or more than twice as long as high, moderately convex centrally and anteriorly, and alate and produced behind; pallial margin long, nearly straight along the middle, rounded up anteriorly and ascending more gradually behind; posterior side very narrow, truncated and somewhat gaping at the extremity, which intersects the cardinal margin at an obtuse angle, and rounds abruptly into the base; anterior side wider (higher) than the other, and more or less abruptly rounded. Dorsal margin depressed below the horizon of the beaks behind the latter, where it is concave or nearly straight in outline, and inflected so as to form a short corselet near the beaks; while in front of them it slopes forward rather abruptly, and is provided

more closely arranged, but above and behind this they become more widely separated again, and nearly as oblique as the obscure umbonal ridge, above which they are not defined.

Length, 2.28 inches; height, 1 inch; convexity, about 0.85 inch.

This shell strongly reminds one, by its general outline and physiognomy, of those Jurassic species for which Prof. Agassiz proposed the genus *Cercomya*. In that group, however, there is no lunule, and I am not aware that any of the species of the same are marked by radiating costæ as in the species under consideration. From all that is known of its characters, I am inclined to believe it more nearly allied to the curious Lyonsia-like Carboniferous shells, upon which Prof. McCoy originally proposed to found the genus *Sedgwickia*, but which he afterwards referred to the genus *Leptodomus*. Still, it differs from the group *Sedgwickia* also, in the possession of radiating costæ. These are not mere rows of granules, such as doubtless existed on nearly all the different types of this family (*Anatinidæ*), but decided costæ, such as we see in *Pholadomya*, and, what is rather singular, they do not exist on the anterior part of the valves, but extend only as far forward as the beaks, under which they end abruptly, the anterior one being as strongly defined as any of the others, while only the concentric striæ and wrinkles exist on the anterior third of the valves. In the possession of the radiating costæ mentioned, as well as in the shortness of its hinge and the inflection of its cardinal margin, and in its general physiognomy, it differs from the typical species of *Allorisma*, and hence it may be thought desirable to establish a subgenus for its reception, in which case I would propose for the group the name *Cercomyopsis*.

Along with the typical specimen of the foregoing species, another was found, with the same form and surface characters, excepting that the anterior end in front of the beaks is shorter, and more angular at the lower end of the lunule; while the anterior of its radiating costæ are directed much more obliquely backward, instead of descending vertically from the beaks to the base. This specimen has the posterior end broken away, but as the peculiarities mentioned seem not due to any distortion, I am much inclined to believe it belongs to another species, for which *Allorisma* (*Sedgwickia*?) *obliqua* would be a good name.

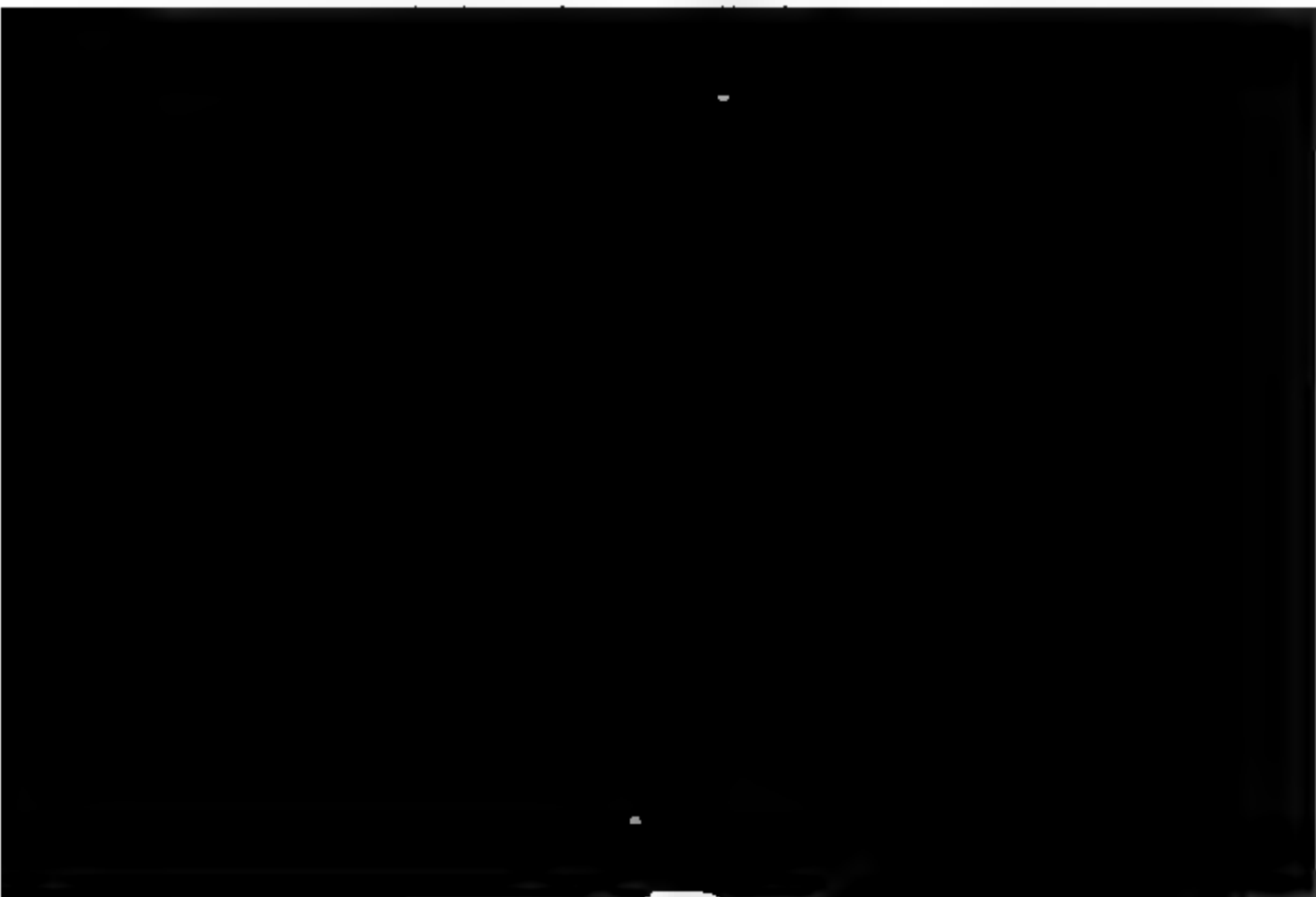
*Locality and position.* Rushville, Ohio. Waverley group of Lower Carboniferous. Prof. Andrews' collection.

1871.]

**GRAMMYSIA? RHOMBOIDES, Meek.**

Shell attaining a moderately large size, not very convex, the greatest convexity a little before and above the middle; valves without an oblique mesial ridge or fold; rhombic suboval in outline, with height equalling about three-fourths the length, closed or nearly so all around; basal margin most prominent just behind the middle, from near which it ascends with a nearly straight outline obliquely forward, and more abruptly with a convex outline behind; anterior side truncated obliquely forward from the beaks above, and very narrowly rounded near the middle; posterior side less narrowly rounded at the middle, with its upper edge probably sometimes obliquely truncated; cardinal margin equalling about one-third the length of the valves, and inflected so as to form a well-defined escutcheon that narrows backward from the beaks; lunule rather deep, well defined, lance-ovate in form, and as long as the truncated anterior dorsal slope; beaks moderately prominent, not very gibbous or very strongly incurved, and situated a little nearer the middle than the anterior margin; posterior umbonal slopes forming a very obscure rounded ridge, between which and the dorsal and posterior dorsal margins there is a rather narrow, slightly concave, or flattened space on each valve. Surface with only small marks or lines of growth, which are gathered into very small obscure wrinkles along the margins of the lunule.

Length, 2.90 inches; height, measuring vertically from the most prominent part of the beaks to the horizon of the tops of



in that group until its relations can be more precisely determined from the study of better specimens.

*Locality and position.* Same as last.

**GRAMMYSIA VENTRICOSA, Meek.**

Shell attaining a moderate size, extremely ventricose, the convexity being greater than the height, with the greatest gibbosity a little in front of and above the middle; height equalling about half the length; posterior side comparatively long, a little gaping, and narrowly rounded in outline, at or a little above the middle; pallial margin usually a little sinuous near the middle or in front of it; anterior side very short, concave just under the beaks to the base of the lunule, where the margin is subangular or very abruptly rounded and most prominent, while below this it rounds obliquely backward into the base; cardinal margins scarcely more than equalling half the entire length of the valves, and inflected so as to form a kind of shallow escutcheon; beaks very gibbous, moderately elevated, oblique, strongly incurved, and placed almost over the anterior margin; lunule deep, ovate or obovate, and well defined; posterior umbonal slopes prominently rounded; flanks without any oblique ridge or sulcus. Surface marked on the anterior side of the valves near the lunule by small wrinkles, which pass into mere lines and linear furrows of growth farther back, while even the latter become nearly or quite obsolete over the more gibbous parts of the valve.

Length of largest specimen seen, 2.50 inches; height, 1.30 inches; convexity, 1.55 inches.

I know nothing of the hinge or muscular and pallial impressions of this shell, and refer it to *Grammysia* from its form and general appearance. It shows no traces of the oblique ridge and furrows seen on the typical species of that genus, but it is well known that this character is not constant in the group.

*Locality and position.* Same as foregoing.

**GASTEROPODA.**

**PLATYCERAS MULTISPINOSUM, Meek.**

Shell attaining a large size, comparatively thin, depressed sub-ovate, and very oblique; apex free, stout, obliquely coiled so as 1871.]

to make about one turn, beyond which the body part expands very rapidly to the aperture, making less than half of another volution; aperture proportionally very large, and nearly circular; lip not sinuous or undulated, but sometimes slightly, and broadly retreating behind; surface without plications or costæ, but thickly covered by numerous slender, tubular spines, which leave small, depressed, smooth, undefined tubercles on the internal cast.

Length, measuring direct from the most prominent part of the spire to the anterior margin of the aperture, 3.33 inches; height, to the most elevated part of the dorsal surface, when the shell is placed with its aperture downward, 1.44 inches; length and breadth of aperture, each about 2.90 inches.

This fine species differs from *P. dumosum*, Conrad, not only in its much larger size, more oblique, depressed, and more rapidly expanding form, but in having more numerous spines. The largest specimens of that species are said to have more than one hundred spines, while that under consideration must have had more than two hundred. It likewise differs in not having its lip waved or undulated as in Mr. Conrad's species.

It is probably more nearly related to *P. echinatum*, Hall, from the Hamilton group. No figures of that species have yet been published, but judging from the description, our shell is not only very much larger (that species being described as from one inch to one and a quarter inch in length, with an aperture one inch in diameter), but wants the sinuous peristome mentioned in the description of *P. echinatum*. The term "strong nodes" would

*Locality and position.* Columbus, Ohio. Corniferous group of Devonian series.

**PLATYCERAS ATTENUATUM, Meek.**

Shell attaining a moderate size, very slender and elongated. Body part more or less arched above, a little compressed behind,<sup>1</sup> subangular on the right side, rounded over the dorsal or anterior slope, and gradually tapering backward to the small free apex, which is composed of one to one and a half contiguous volutions, and twisted to the right of the longitudinal axis of the free body. Aperture irregularly oval or suborbicular, and comparatively small or little expanded; lip most produced on the right anterior side, and sometimes a little retreating behind, with one or two other faint, smaller undulations of its margin around the front. Surface of cast without longitudinal plications, folds, or undulations, but showing over the dorsal and anterior slope numerous small tubercles that evidently mark the positions of spines on the exterior. Surface markings of the shell itself unknown.

Length of the largest specimen, measuring direct from most prominent part at the curve of the spire to that of the anterior margin of the aperture, 2.10 inches; do. measuring from the apex over the dorsal curve to the same, about 3.70; greatest breadth of aperture, 1.35 inches.

This shell seems to differ from all of the described spiniferous species with which I am acquainted, in being more slender, more elongated, and in having the small apex twisted nearly at right angles to the axis of the body part. These characters appear to distinguish it readily from the typical *P. dumosum*, Conrad; while from the variety of that species that has been described under the name *rarispinum*, it differs in never having its body even "moderately ventricose," nor in any case in contact with the apical coils, as well as in having more numerous spines, if we can judge from the number of tubercles, of which about fifty may be counted on the specimen from which the foregoing description was made out.

In general form it resembles the more slender individuals of the non-spiniferous species *P. reflexum*, from the Oriskany sandstone,

<sup>1</sup> I describe such forms, for convenience, as if placed with the aperture downward and the apex directed backward toward the observer.

but its body part is much straighter, while it is never so large and ventricose as in some varieties of that species.

*Locality and position.* Columbus, Ohio. Corniferous group.

**NATICOPSIS LEVIS, Meek.**

Shell apparently attaining a medium size, subovate in general form, at maturity, but proportionally shorter in the young; spire moderately prominent; volutions four to four and a half, convex, increasing rather rapidly in size; last one large, or forming near nine-tenths of the entire bulk of the shell, rounded on the sides, and a little extended below; suture well defined; aperture ovate, being regularly rounded below, and more or less angular above; columella arcuate, and distinctly flattened, or a little concave below the non-perforate umbilical region, above which the inner lip is thickened. Surface only showing obscure lines of growth.

Length of the largest specimens seen, 0.60 inch; breadth, 0.48 inch; height of aperture, 0.38 inch; breadth of do., 0.27 inch.

So far as I am at present informed, this is the first Devonian species, beyond doubt known to belong to this genus, that has yet been described in this country; though it is certainly represented in rocks of that age in Europe.<sup>1</sup> Our species is even more closely allied to the typical Carboniferous forms of the genus, than it is to the European Devonian species, such as *Naticopsis subcostata* and *N. margaritifera* (= *Natica subcostata* and *N. margaritifera*, d'Archi and de Verneuil).

creasing rapidly in size, those of the spire convex, last one large and ventricose; suture well defined; aperture ovate; outer lip thin, extended forward and very oblique above, and broadly retreating or sinuous below the middle; columella narrow arcuate, imperforate, and showing some appearance of being a little furrowed below, as if for the reception of the edge of an operculum; inner lip apparently not thickened above. Surface ornamented by fine, very regularly and closely arranged striæ of growth, which pass very obliquely backward and downward on the upper and outer side of the body volution, and then curve gracefully forward again below, so as to conform to the broad sinuosity of the outer lip.

Height, 0.17 inch; breadth, 0.18 inch.

This little shell will be at once distinguished from the young of the last, of corresponding size, with which it agrees very nearly in form, by its beautiful, very regular, well-defined, and gracefully curved striæ, as well as by its narrower columella, and thin inner lip. The latter characters lead me to doubt whether it is not more properly a *Platyostoma*.

*Locality and position.* Same as last.

#### BELLEROPHON NEWBERRYI, Meek.

Shell scarcely attaining a medium size, subglobose in form; volutions rounded, all hidden by the last one, the umbilicus being closed on each side; last turn expanded at the aperture, which is rather large, transversely lunate or subreniform, being nearly twice as wide transversely as the antero-posterior diameter; lip moderately sinuous in front, and rounded in outline on each side, very thin excepting in the umbilical regions, between which it is thinly spread a little over that part of the return of the spire indenting the inner or posterior side of the aperture. Dorsal band rather narrow, not usually elevated above the surface of the rounded dorsum, and merely defined by a slight furrow along each side.<sup>1</sup> Surface ornamented by distinct, very regularly disposed little transverse costæ, or coarse raised lines, most strongly defined on the dorsal side, where they curve a little backward near the band, and more abruptly in crossing the latter; while they become finer, more curved, and directed backward in approaching the

<sup>1</sup> In one of the smaller specimens, the band is a little raised so as to form a slight ridge.

umbilical region on each side, and diminish to mere fine lines of growth on the expanded part of the body volution near the aperture. Traces of much finer longitudinal, or revolving lines are also seen on well-preserved specimens.

Greatest antero-posterior diameter of a moderate-sized specimen, 0.70 inch; transverse diameter of aperture, 0.72 inch.


In its surface markings, this species seems to agree with *B. patulus*, Hall, from which it differs materially in having its aperture very much less expanded, and not overlapping the volutions posteriorly; as well as in not having its axis umbilicate. It is much more nearly like *B. hiulcus*, Sowerby, as illustrated by de Koninck (Ann. Foss. Carb. Belg., pl. xxvii, fig. 4, a, b, c), but in addition to being much smaller, its aperture is less transverse, and not near so deeply sinuate posteriorly by the inner volutions; while its lip is very much less spread over the latter behind. It likewise differs in the possession of fine obscure revolving striae.

The specific name is given in honor of Prof. J. S. Newberry, the State geologist of Ohio.

*Locality and position.* Dublin, Franklin Co., Ohio. Corniferous group of the Devonian.

#### **BELLEROPHON PROPINQUUS, Meek.**

This species agrees so nearly with the last in form and size, that it may be sufficiently characterized by pointing out the few characters in which it differs. In the first place, its transverse lines are distinctly finer, more crowded, and less regularly arranged; while



**CYCLONEMA CRENULATA, Meek.**

Shell turbate, subtrochiform, thin; spire depressed conical; volutions four, increasing rather rapidly in size, those of the spire convex but not rounded; last one large, convex on the upper slope to the periphery, which is rather narrowly rounded; suture well defined between the upper volutions, and somewhat canaliculate farther down; aperture ovate. Surface ornamented by sharply elevated revolving lines or small ridges, which are beautifully and minutely crenate by the crossing of the fine, very oblique lines of growth; of these revolving lines from sixteen to eighteen may be counted on the body volution, and six on the next above, while those farther up appear to be quite smooth.

Length, 0.34 inch; breadth, 0.32 inch.

This species seems to be related to *C. multilira*, Hall (Fifteenth Report of Regents, p. 48, pl. 5, fig. 17), but has a more depressed form, with the volutions of its spire merely convex instead of rounded, and its body volution narrowly instead of regularly rounded. It also has more revolving lines, which likewise show a delicate crenate character not represented in the figure nor mentioned in the description of *C. multilira*.

In general appearance our shell more nearly resembles Mr. Conrad's original figure of his *C. bilix* (Journ. Acad., N. S. VII, pl. xvi, fig. 10), but it is less oblique, with more convex volutions, and more numerous revolving lines.

*Locality and position.* Same as last.

**ISONEMA HUMILIS, Meek.**

Shell large and robust, depressed subturbinate, about one-fourth to near one-third wider than high; spire much depressed; volutions four, increasing rather rapidly in size, the exposed part of those of the spire gently convex; last one large and regularly rounded, or sometimes very obtusely subangular around the middle of the outer side; suture well defined, without being properly channelled; aperture circular a little within, but more or less angular above at the immediate edge of the lip, where it is more oval in outline; outer lip thin, and, in mature specimens, slightly dilated; inner lip thickened, very distinctly flattened, and slightly spread over the imperforate umbilical region, as well as a little thickened near the top of the aperture. Surface ornamented

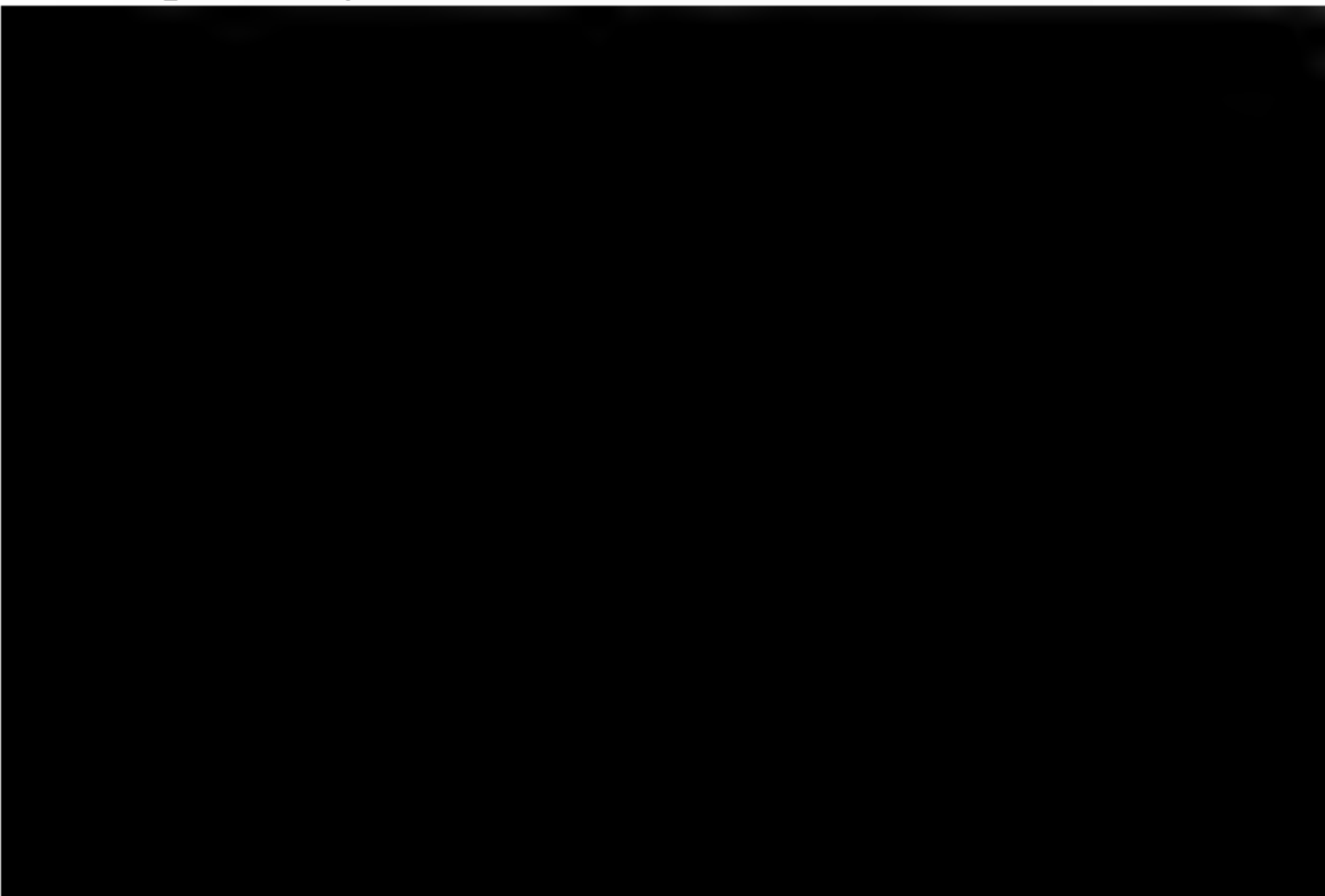
1871.]

with oblique, slightly arched lines of growth, which, on the first and second turns of the spire, are rather coarse, well defined, and present the characteristic regularity of size and arrangement, but soon become, on the succeeding turns, much finer and more crowded, as well as occasionally interrupted by irregular, stronger furrows and wrinkles of growth.

Height of a medium-sized specimen, 1.10 inches; breadth, 1.50 inches; height of aperture, measuring at the margin of the lip, to the top of the angle above, 0.95 inch; breadth, about 0.87 inch.

It is possible that this may be the full-grown adult form of *Isonema depressa*, M. & W., as its first and second volutions have much the form and surface markings of that shell. Still, as it shows only the same number of volutions in specimens of nine or ten times the volume of the typical specimen of that species, I am led to believe it distinct. Although young specimens are more inclined to be subangular around the middle of the outer turn than in the adult, which often has the body whorl regularly rounded, I think it is never at any stage of growth so angular as in the *I. depressa*.

In large examples, with the strong striæ of the first turns of the spire obscured by erosion, the specimens of this shell (which are usually preserved in such a condition as to present a perfectly white chalk appearance), when viewed from above, resemble very much the bleached shells of some of the large depressed forms of *Helicidæ*. The strongly flattened, smooth inner lip, however, gives a very different expression to the under side.



**ORTHONEMA NEWBERRYI, Meek.**

Shell turreted, elongate-conical; volutions eight or nine in adult examples, compressed-convex, with a more outward slope than the general slant of the spire, the most convex part being near the lower side of each, a little above the suture; first one or two very small and depressed, and the next one or two more rapidly increasing in size than those below, thus giving a proportionally shorter and more conical appearance to young than adult specimens; suture well defined, in consequence of the prominence of the lower part of each turn just above. Surface ornamented by three very slender, raised revolving lines, one of which is placed a little below the suture, and the other two below the middle of the turns of the spire, and on the middle of the last volution; of these revolving lines the upper two are broken up into minute, regularly arranged, projecting points, while the other is usually continuous; lines of growth minute, sharply defined, and very regularly and closely arranged, passing vertically and very nearly or quite straight across the volutions. (Aperture unknown.)

Length, 0.63 inch; breadth, 0.22 inch.

The general appearance of this very neat little shell, with its three slender revolving lines, two passing around the middle of its body volution, and below the middle of those of the spire, at once recalls to the mind the genus *Murchisonia*. A moment's examination under a magnifier, however, shows that the sharply defined lines of growth pass straight across the volutions, without making the slightest flexure indicating a sinus in the lip, such as we see in *Murchisonia* and *Pleurotomaria*.

It is a more slender shell than the type of the genus, *O. Salteri*, M. and W., from the Coal-measures, and has a much deeper suture, and less angular body volution, with other differences in the details of its markings. Although nothing is known of the nature of its aperture and columella, it agrees so exactly in all its other generic characters with the genus *Orthonema*, that I have no hesitation in referring it to that genus. It is certainly not a *Murchisonia*, and differs radically in its ornamentation from *Loxonema*, and all of the other palæozoic types to which the more or less similar univalves of the older rocks are usually referred.

*Locality and position.* Otsego, Wood County, Ohio, from the Corniferous groups, just above the Glass Sand. Mr. Gilbert. 1871.]

**TROCHITA? ANTIQUA, Meek.**

Shell strongly depressed, subtrochiform, about three times as wide as high; under side flattened and provided with a broad, shallow, excentric umbilical impression; volutions two and a half to three, a little convex, with a gentle outward slope above, and an angular periphery at the connection of the upper slope of the whorls and the base; suture rather obscure; aperture transversely rhombic; nearly three times as wide as high, with acutely angular outer and inner extremities; upper edge of lip very oblique, and extended far forward beyond that below, which seems to be nearly straight. Surface of upper side ornamented by rather distinct lines, or small ridges of growth, which cross the volutions very obliquely, with strong backward curves as they approach the periphery parallel to the margin of the lip.

Breadth, 2.12 inches; height, 0.66 inch.

The specimens of this shell yet found are very imperfect, but its form and general appearance are so peculiar that there can scarcely be any difficulty in identifying it. Although it has a broad umbilical impression, this impression does not appear to extend up into the very short spire as a true umbilicus. It may not be a true *Trochita*, but the specimens yet seen show no characters by which it can be separated from that group, which seems to be represented in the Carboniferous rocks.

*Locality and position.* Monclova, Lucas County, Ohio. Carboniferous group of the Devonian.

than wide, and somewhat angular above, at the connection of its outer lip with the return of the spire, and at the termination of each of the three revolving carinæ, as well as very obscurely so a little below the middle of the inner side; inner lip thin below its connection with the carina passing around the umbilicus, at which point it is very slightly thickened, while above this it seems to be nearly or quite obsolete. Umbilicus rather wide, but shallow, or very rapidly contracting within. Suture well defined, without being in the slightest degree furrowed. Surface only showing very fine lines of growth, which, on the upper flattened space of the volutions, pass obliquely outward and backward, with a very slight curve from the suture to the upper angle or shoulder, below which they pass nearly straight down the outer flattened area to the second carina, which is as far as they can be traced in the specimen studied.

Height, 0.81 inch; breadth, 0.90 inch; height of aperture, 0.54 inch; breadth of do., 0.46 inch.

This rather neat shell seems to agree exactly in all of its generic characters with the type of Mr. Salter's genus *Trochonema* (*T. umbilicata*, Hall, sp.), excepting in not even showing any tendency to have its body volution become free at the aperture, nor apparently its peritreme continuous. The first of these characters, however, seems not to be always constant in the typical species of *Trochonema*; but the fact that it *does generally* occur in the same is worthy of note; while the apparent absence of a continuous peritreme in the shell here under consideration, would certainly seem to be one of more than specific importance. If so, I would suggest for it, at least as a subgeneric designation, the name *Trochonemopsis*.

Specifically this shell will be readily distinguished from *T. umbilicata*, which it most nearly resembles, not only by its more depressed form, closely contiguous body volution, obsolete inner lip above the middle of the aperture, and more shallow umbilicus, but also by not having its suture channelled and bordered below by a fourth carina around the upper margin of each volution, as in that species.

*Locality and position.* Marblehead, Ohio. Corniferous group.

NOTE.—In the same matrix with the above-described shell, I have been surprised to notice numerous minute bodies that I can scarcely doubt are

really the fruits of the fresh-water genus *Chara*. At any rate, they certainly seem to present all the external characters of the same. These little bodies are globose, about 0.05 of an inch in diameter, and each ornamented by nine strongly defined, and very regularly disposed, spiral ridges, which start on one side around a minute pit, and pass with perfect regularity spirally so as to converge to an exactly opposite point on the other side, making each about one spiral turn in passing from side to side. If really the seeds of this fresh-water genus of plants, they must have been carried into the sea by streams, and deposited where we now find them, along with numerous marine shells.

## PTEROPODA.

### *CONULARIA MICRONEMA*, Meek.

Shell elongate-pyramidal, with the sides equal and diverging from the apex at an angle of about 16 degrees; lateral surfaces nearly flat, and without any mesial furrow, but sometimes showing a very faint, slender mesial ridge, that becomes nearly or quite obsolete toward the smaller end; each of the four angles a little rounded, and provided with a shallow, moderately distinct longitudinal furrow. Surface with numerous, extremely small, closely crowded, transverse striæ, of very nearly the same size on all parts of the shell; striæ gently arching forward as they cross the sides, and scarcely interrupted at the little mesial longitudinal ridge; minutely crenate, and separated by extremely slender linear furrows, numbering fifteen in the space of one-tenth of an inch on all parts of the surface; crenulations of striæ twelve to fifteen in one-tenth inch.

**CONULARIA ELEGANTULA, Meek.**

Shell presenting the usual quadrangular pyramidal form, with the divergence of the sides from the rather pointed apex, forming an angle of about 18 degrees; each of the four lateral angles slightly rounded and distinctly furrowed; sides equal, nearly flat, and without any well defined longitudinal mesial furrow. Surface ornamented by numerous, very small, closely arranged, transverse lines that arch gently forward or toward the aperture, and sometimes become slightly interrupted and alternating along the middle of each side; while in other instances they are merely a little deflected and continuous across this slight impression or imaginary line. These lines attain their largest size, and are separated by spaces of their own breadth, at about 0.70 inch from the apex, and beyond this become gradually smaller and more crowded toward the aperture. Where largest and widest apart, they number about seven in one-tenth of an inch. They are all crenulated, there being fourteen of the crenulations in a length of one-tenth of an inch. Furrows between the transverse lines marked by very fine striæ, much smaller and more crowded than the crenulations on the striæ, and running in the direction of the longitudinal axis of the shell.

Length of specimen, apparently nearly entire, 1.70 inches; breadth, about 0.59 inches.

This species is related to *C. byblis* of White (Proc. Bost. Soc., N. H., Feb. 1862, p. 22), and *C. multcostata*, M. & W. (Proc. Acad. Sci., Phila., Dec. 1865, p. 252), from the Waverley group of Iowa and Ohio. It differs, however, in having its transverse lines smaller and more crowded, there being about 70 of them to the inch, at the point where they are largest and widest apart, and 100 in the same space near the larger end of the shell; while in both of the Waverley species mentioned, only forty-five to fifty occur in an inch. The crenulations of the transverse striæ are also smaller and more crowded in the species under consideration, there being usually fourteen of them in one-tenth of an inch, which would give 140 to the inch; while, according to Prof. Winchell's measurements, they are so much larger and more distant in *C. byblis*, that 60 to 75 of them would occupy the same space. The obtusely rounded and smooth apex mentioned in Dr. White's description, if natural, would be another very important distinction; 1871.]

THE  
FEDERAL  
BUREAU OF INVESTIGATION

REPORT OF THE  
SPECIAL AGENT IN CHARGE  
OF THE  
BUREAU OF INVESTIGATION  
ON THE  
PROSECUTION OF THE  
CASE OF  
THE  
FEDERAL BUREAU OF INVESTIGATION  
ON THE  
PROSECUTION OF THE  
CASE OF  
THE  
FEDERAL BUREAU OF INVESTIGATION

REPORT OF THE  
SPECIAL AGENT IN CHARGE  
OF THE  
BUREAU OF INVESTIGATION

REPORT OF THE  
SPECIAL AGENT IN CHARGE  
OF THE  
BUREAU OF INVESTIGATION

REPORT OF THE  
SPECIAL AGENT IN CHARGE  
OF THE  
BUREAU OF INVESTIGATION  
ON THE  
PROSECUTION OF THE  
CASE OF  
THE  
FEDERAL BUREAU OF INVESTIGATION  
ON THE  
PROSECUTION OF THE  
CASE OF  
THE  
FEDERAL BUREAU OF INVESTIGATION

diameter at the same place, 1.27 inches. The increase in size is such that the same measurements at a point three inches farther forward, are respectively 1.56 and 1.50 inches, while from this point to the broken anterior end, which includes only about one inch of the body chamber, the shell diminishes a little in both diameters, but apparently more in the transverse than the dorso-ventral, though this may be in part due to accidental lateral pressure.

This species seems to be related to *Cryptoceras eugenium*, Hall (Regents' 15th Report, p. 70, pl. 9, figs. 1, 2, and 3), but evidently not only attained a larger size, but differs in having its dorso-ventral diameter a little greater than the transverse, instead of the reverse. It also differs in being marked with distinct longitudinal raised lines, as well as in tapering somewhat, from the central region forward, and in having its septa more closely arranged. In form it agrees more or less nearly with several of the Bohemian species figured by Dr. Barrande, but it differs from all of them in its surface markings; while from his *C. pugio*, which has somewhat similar sculpturing, it differs in being a little more curved, and without transverse undulations.

The entire shell could scarcely have been less than 12 to 14 inches in length, and probably curved so as to form about one-fourth of a circle.

*Locality and position.* Dublin, Franklin Co., Ohio. Corniferous group of the Devonian series.


#### GYROCERAS (TROCHOCERAS ?) OHIOENSE, Meek.

Shell attaining a large size, oval-subdiscoid; composed of three or four rather rapidly enlarging whorls, the inner ones of which are closely contiguous, while the last one seems to become a little free at the aperture; umbilicus large and of moderate depth. Volutions rounded—subquadrangular, with the transverse diameter somewhat greater than the dorso-ventral; rather broadly flattened on the periphery, and compressed convex on the sides, which round off gradually into the umbilicus, and more abruptly to the periphery, excepting in young shells, which have the sides of the volutions more flattened, and rounding as abruptly into the umbilicus as to the flattened outer side. Septa moderately distant, or separated by spaces which measure, on the middle of each side, about one-third the dorso-ventral diameter of the volu-  
1871.]

tion at the same point; curving gracefully backward as they cross the sides, and forward as they pass from the sides to the flattened periphery, in crossing which they again make another, but stronger, backward curve. Body chamber large, or occupying more than half the outer volution. Surface (of cast) ornamented by small transverse ridges, of which about thirty may be counted to a side of each volution, the outer half only of which they occupy, without passing over or upon the periphery; while on the inner volutions they are sometimes so short as to assume the aspect of transversely elongated nodes. Siphuncle, aperture, and finer surface markings unknown.

Greatest diameter across the disc of a specimen with a part of the outer volution broken away, about nine inches; dorso-ventral diameter of outer volution at the point where it is broken off, 3.63 inches; thickness, or transverse diameter, of same at same point, about 3.90 inches.

Owing to the fact that the only two specimens of this species I have seen are both in such a condition as to show clearly only one side (the upper side of it is a *Trochoceras*), I am in some little doubt whether it is a *Gyroceras* or a *Trochoceras*. From the depth of the concavity of this side, however, I can scarcely question that the volutions are really coiled in the same plane, as in *Gyroceras* and *Nautilus*. The contiguous character of its volutions (excepting apparently the last one, near the aperture) is, however, rather against its being a *Gyroceras*, though the inner turns are sometimes in contact in species apparently belonging to that



**GYROCERAS (NAUTILUS?) INELEGANS, Meek.**

Shell attaining a large size, subdiscoidal. Volutions about two and a half to three, increasing rapidly in size, having a somewhat greater dorso-ventral than transverse diameter, being moderately compressed on each side, narrowly rounded over the periphery, and rounding regularly into the umbilicus, which is of moderate depth and distinctly narrower than the dorso-ventral diameter of the outer whorl. First turn apparently slightly embraced by the second, which seems to become free toward the aperture. Septa rather distant, deeply concave on their anterior faces, and all crossing the sides and periphery with very slight backward curves; separated from each other on the periphery by spaces equalling about half the dorso-ventral diameter at the point of measurement. Body chamber large, or forming half the outer volutions; aperture not expanded; lip sinuous on the outer side. Surface of cast showing, on the inner volutions, some traces of rather distant transverse ridges, which become nearly or quite obsolete on the outer turn. Siphuncle and finer surface markings unknown.

Greatest diameter across the disc of a specimen a little compressed by accidental pressure, nine inches; dorso-ventral diameter of last turn near the aperture, 4.10 inches; transverse diameter of same, 3.50 inches.

This is another form in regard to the generic characters of which I am in doubt. Its more rapidly expanding volutions, more rounded periphery, proportionally narrow umbilicus, and closely contiguous, or even slightly embraced inner turns, give it a much more nautiloid look than the last, and I should scarcely hesitate to refer it to the genus *Nautilus*, if it were not for the fact that the outer volution seems to be a little detached at the aperture. Still, this may possibly be due to compression.

*Locality and position.* Corniferous group, Marion County, Ohio.

**CRUSTACEA.****PROETUS PLANIMARGINATUS, Meek.**

Pygidium depressed, semi-elliptic, the length and breadth being nearly as five to seven; anterior margin gently arcuate or convex in outline; posterior somewhat narrowly rounded; lateral margins diverging forward, with slightly convex outlines, to the anterior 1871.]

lateral angles, which are not truncated. Mesial lobe rather depressed, but rounded and well defined, narrow, or only about two-thirds as wide at its anterior end as the lateral lobes, tapering gradually, with straight sides, to its posterior extremity, which terminates at a distance of about half the breadth of the anterior end, within the margin; provided with about twelve or thirteen nearly straight segments, most of which are well defined. Lateral lobes gently convex, sloping gradually from near the middle to the lateral and posterior margins, which are horizontally flattened, but not thickened; segments eight or nine, not extending upon the flattened margins, and each divided its entire length, by so broad a furrow (flat within) that only a very narrow anterior and posterior margin is left projecting, and merely separated from that of the contiguous segment by a faint linear depression, thus presenting the appearance of narrow ribs or segments longitudinally marked by faint linear furrows, and separated from each other by broad flattened depressions. Surface apparently nearly smooth. (Other characters unknown.)

Length of pygidium, 0.64 inch; breadth, 0.94 inch; height of lateral lobes, 0.13 inch; do. to top of mesial lobe at its anterior end, 0.23 inch.

The pygidium of this species seems to present much the same proportions as the corresponding part of *P. Haldemani*, Hall, from the Hamilton group; but it has a proportionally narrower mesial lobe, and a smaller number of segments in the lateral lobes. It also differs in having a distinctly flattened instead of

with the smallest elevations and depressions of the internal cast, from which the foregoing description was drawn up.

*Locality and position.* Upper part of the Corniferous group, Sylvania, Lucas County, Ohio. Devonian. Mr. Gilbert's collection.

**DALMANITES OHIOENSIS, Meek.**

Pygidium large, depressed, semi-elliptic or semi-oval in general outline, nearly straight or gently convex in outline on the anterior margin, with the lateral angles a little rounded; posterior extremity somewhat raised and truncated, with the lateral angles of the truncated margin produced into two rather short, distinctly converging spines. Mesial lobe narrow, or only equalling half the breadth of each lateral lobe at the anterior ends, depressed and gradually tapering to the posterior end, which terminates very near the truncated posterior margin; rather distinctly separated by the furrow on each side from the lateral lobes; segments about eighteen, passing straight across, and separated by well-defined furrows, that are narrower than the segments themselves, which are not furrowed. Lateral lobes most convex along somewhat within the middle, where they are nearly or quite as high as the mesial lobe, toward which they slope slightly on the inner side, while beyond the middle they slope off gradually to the lateral margins, which are very narrow, not thickened above, and curve outward nearly horizontally; segments about fifteen, widening slightly outward, and separated by deep, well-defined furrows extending very nearly to the lateral margins; the larger ones showing faint traces of a slender longitudinal furrow along the middle, while all, excepting a few of the smallest posterior ones, are produced beyond the lateral margins in the form of slender, sharp rounded spines, that curve a little backward and upward. Surface nearly or quite smooth. Thorax and cephalic shield unknown.

Length of pygidium, 1.70 inch; breadth, 2.70 inches; height or convexity, 0.25 inch; breadth of posterior truncation, 0.45 inch; length of longest spines projecting from lateral margin, 0.38 inch.

This Trilobite seems to be closely allied to *D. myrmecophorus* (= *Asaphus myrmecophorus*), Green, to which I was at one time inclined to refer it. A careful comparison, however, with the 1871.]

description of that species given by Green and Hall, seems to show that our fossil cannot be properly considered identical. In the first place, it differs in having the mesial lobe only just half as wide as each of the lateral (measuring both at their anterior ends), instead of only about one-third as wide (see dimensions *D. myrmecophorus*, given in the Fifteenth Report, Regents Univ. N. Y., on State Cab. N. H., p. 18). Again, it shows no traces whatever of nodes or spines (excepting the marginal spines) on any of the segments, either of the mesial or lateral lobes; while in Green's species the segments of the lateral lobes are described, in the Regents' Report above cited, and also by Green, as being marked by one or two rows of nodes, and those of the mesial lobe are described in the Regents' Report as being marked each by three spines. Our species also shows a faintly impressed mesial line along each segment of the lateral lobes, not mentioned either by Hall or Green in describing *D. myrmecophorus*.

Green gives the number of segments in the middle lobe of the pygidium as fourteen, and in each lateral lobe as thirteen; while in apparently a larger specimen (three inches in length), Prof. Hall counted twenty-four segments in the axis, and twenty in each lateral lobe; from which we may infer that the number of segments varied somewhat with the size of the specimen in that species.

Although nothing is known of the cephalic shield of this species, or, I believe, of that described by Green, I have little or no hesitation in expressing the opinion that at least the form here under

proportionally decidedly smaller. This, I suspect, belongs to a distinct species; but, as the specimen is too much eroded to show surface character clearly, I have preferred to refer it doubtfully, for the present, to the same.

*Locality and position.* Marblehead, Ohio. Corniferous group of the Devonian.

## ON CERTAIN SPECIES OF FALCONIDÆ, TETRAONIDÆ, AND ANATIDÆ

BY ALFRED NEWTON,

PROFESSOR OF ZOOLOGY IN THE UNIVERSITY OF CAMBRIDGE, ENGLAND.

[Communicated by Mr. Cores.]

MAGDALENE COLLEGE, CAMBRIDGE.

28th November, 1869.

MY DEAR SIR: I have just received your letter of the 9th inst. I have the greatest pleasure in giving you all the information in my power.

As to the Great Northern Falcon question—I cannot count more than six men in Europe who really understand it. It would be invidious to name them. Two of them, Schlegel and Blasius, I had the pleasure of converting from their old heresies. I endeavored to bring Cassin to a right understanding of the matter when I was in Philadelphia more than a dozen years ago, but I did not succeed, and consequently his notice in the "Birds of North America" (p. 13) is all wrong. I have not much to add or anything to retract from some remarks of mine on this question in "The Ibis" for 1862 (pp. 44–53), in my appendix to Baring-Gould's "Iceland" (pp. 404, 407), and in the "Oötheca Wolleyana" (pp. 85, 87).

The first thing to become fully impressed with is that these large falcons have exactly the same changes of plumage as *Falco*

blue birds marked "jeune." It is the same with specimens from Copenhagen and elsewhere. Now it being understood that, as I have above said, the age of the bird may be detected from the color, and, still better, from the direction of the markings, it will then be evident that in a large series you have what at first sight appears to be almost every step from the nearly pure white phase—which some consider, though I do not, to be the *F. arcticus* of Holböll—to the dark-colored *F. labradora* of Audubon, and it is not easy to see how they can be distinguished. Easy it is, however, on trial. Sort out all the specimens with white bills and claws (the white is often flesh-colored owing to extravasated blood), and then you will have *Falco candicans*. Then turn all the other specimens on to their bellies, and lay in one heap those that have the tops of their heads *not darker* than their backs, and on another those that have the tops of their heads *not lighter* than their backs. The first of these heaps will be *F. islandicus*, and the second *F. gyrfalco*. You will have perhaps some five per cent. that this test will not reach, and this remainder will require further comparison; but I am much mistaken if the "moustache" will not enable you to distribute the balance. Then you may look at the labels—always being, of course, suspicious of French geography—and I think you will have something like this result:—

| BILL AND CLAWS.            | PLUMAGE ABOVE.            | SPECIES.               | LOCALITIES.                                       |   |
|----------------------------|---------------------------|------------------------|---|---|
|                            |                           |                        | <i>Adult.</i>                                     | <i>Immature.</i>  |
| White or pale flesh color. | White with dark markings. | <i>F. candicans</i> ,  | N. Greenland, N. parts of fur countries, Siberia? | Iceland, British Islands, Norway, Sweden, Canada, U. S., "Siberia" (Pallas), (in Mus. Berol), "Amoor" (Schrenck). |
|                            |                           |                        |   |   |
| Dusky horn color.          | Dark with light markings. | <i>F. islandicus</i> , | Southern Greenland and Iceland. <sup>1</sup>      | British Islands, Norway, Iceland, Labrador, Canada, U. S.   |
|                            |                           |                        |   |   |
|                            |                           | <i>F. gyrfalco</i> ,   | Norway, Sweden, Finland, Siberia?                 | Norway, Sweden, Holland, N. Germany.  |

<sup>1</sup> P. S. 6 May, 1871. Since this letter was written Prof. Baird has kindly sent me some specimens from Alaska to examine. These are adult, and differ from Icelandic examples only in being slightly darker. (P. Z. S. 1870, p. 384.) "Alaska" should, therefore, be added to the localities named above. 1871.]

The adults will be from the countries where each form breeds, and the young from those to which they wander (generally in the autumn or winter).

We have in Europe (including Iceland and Spitzbergen as European), in my opinion, four<sup>1</sup> species of *Lagopus*; for I count *L. scoticus* as a species, since it can be always most readily distinguished from *L. albus*, and has (nowadays) a different habitat, but that it is only *L. albus* modified to suit an insular climate, I am persuaded; just as I am that *Lepus hibernicus* is a mere insulated form of *L. timidus*, Linn. nec auctt. (Cf. P. Z. S. 1864, p. 497.) Of *L. scoticus*, however, I need say nothing here. *L. albus*, of which remains are found in the caves of the "Reindeer period" in the south of France, together with those of *Nyctea nivea*, is nowadays, as you no doubt know, confined to Norway and Sweden in Western Europe, Finland and Russia in the East. Its southernmost limits in Russia I do not know. I think I have read somewhere of its occurring in the very east of Prussia, but I cannot be sure. Between European and American specimens of *L. albus*, I have never been able to detect any difference at all. The *L. brachydactylus* of Temminck, figured by Werner (Atl. Ois. Eur.) and by Gould, is *L. albus*, as I know by the type at Leyden which I have examined (so also says Schlegel somewhere). It is a winter bird with perfectly white remiges; but I may here remark that the variation in the color of the remiges (I speak of the adult, for in the young the primaries first assumed and borne till the first moult are always brown) seems to me but an individual

is very seldom completed, and before all the winter (white) feathers have been shed, some of the ashy-gray autumn plumage are generally observable. Still, a ♂, killed, say in May, always has a considerable number of purely black feathers on his breast. At this time the ♀ is of a bright orange color, vermiculated above with black, and hardly to be distinguished from *L. rupestris* of the same sex and season. Later in the year both sexes put on an ashy-gray plumage (for *Lagopus* has three moults a year), and in this you have the "plumage des noces" of most of the continental dealers. I myself have never seen Pyrenæan specimens, but it is said that they are specifically identical with those of the Alps, and these last are certainly not distinguishable from our own or Scandinavian examples. I am told that there is appreciable difference observable in the size of Scotch specimens according as they are from the summits of the hills or lower down, and I know there is such difference in Norwegian ones. The largest *L. mutus* I ever saw were from Qvalö, the island on which Hammerfest stands, and owing to its proximity to the sea, I suppose, and the influence of the gulf stream (the well-known "Horri-eye" bean is constantly thrown up there), the climate of Qvalö is certainly much more equable and milder than that of the frontier range of mountains between Norway and Sweden, and still more so than such hills as those about Kilpisjeröi, whence have come the smallest specimens I ever handled. I should think two Qvalö birds would weigh as much as three from Kjölen, and the difference of size is plainly visible even in the sternum. But of course no one would wish to separate these birds unless it was Brehm. The fourth European species I hold to be the same as your *L. rupestris*, which *L. mutus* certainly is not. Under the name of *L. hemileucurus* (or, Malmgren would say, *L. hyperboreus*), the Spitzbergen bird has been described as distinct, but I have hardly a doubt<sup>1</sup> remaining that it is in every respect identical with the Islandic *L. islandorum*, which again I hold to be specifically identical with *L. reinhardti* of Greenland, and *L. rupestris* of Labrador, and the

<sup>1</sup> P. S. 6 May, 1871. Dr. Von Heuglin having kindly sent me some examples of the Spitzbergen bird obtained by him last year, an examination of them has entirely changed my opinion on this point. I now believe *L. hemileucurus* to be a good species, and I have stated my reasons for so thinking in notes which will shortly be published by that naturalist or by Dr. Finsch.

Hudson's Bay territory. The females at no time of the year differ much from *L. mutus*, but, so far as I know, the males never in spring assume or attempt to assume a *black* breast—the color of the new spring feathers upon that part being always a dark (blackish if you like) brown, but mottled and freckled with *rust color*. In this stage the bird has none of the fresh look which the brilliant contrast of the pure black and white gives to *L. mutus* ♂. The autumnal plumage of the ♀ *rupestris* I have never been able to make out satisfactorily; but I have some reason to think that it is not of the generally clear ashy-gray hue that that of *mutus* is. This is a point I want especially to be informed upon. They send many skins from Greenland, which I *suspect* are autumnal birds, but the men are content to mark them "Sommer." I have autumnal females from Iceland, where the orange-yellow of the spring is fast giving way to the white of winter, without the intervention of any autumnal gray. What the Icelandic ♂ does at the same time I do not know; I did not stay long enough in Iceland to find out, and the specimens I desired to be sent to me are all apparently females. That *L. islandorum* and *L. reinhardti* are identical, I think there can be no doubt, and I cannot conceive why Brehm ever invented the latter. That *islandorum* and *hemileucurus* (from Spitzbergen) are the same, I also strongly opine,<sup>1</sup> and if I could only get the latter to compare with my skins of the former, I think I could settle the question, but it is rare.

I yesterday received from Malmgren a copy of a paper by him in the "Notiser ur Sällskapet pro Fauna et Flora Fennica För-

4. *A. albifrons* (Gmel.), with a white nail, dark gray carpal feathers, and orange legs.

5. *A. erythropus* (Linn.), much resembling the last, but much smaller (about the size of *Anas boschas*) and perhaps redder orange legs. The synonyms of this bird are: *A. finmarchicus*, Gunnerus, *A. temminckii*, Boie, *A. minutus*, Naumann, and, as I now see by Malmgren, *A. brevirostris*, Fritsch; but this last I have not myself certified.

No. 1. *A. ferus* is undoubtedly the species from which our tame geese have sprung. It formerly bred in England, and now breeds in Scotland, where it is, *I am satisfied*, the only species that does so. (Cf. Ibis. 1865, p. 441; 1869, p. 21.) It also breeds in Iceland. (Ibis. 1864, p. 132.) The Scandinavian naturalists have said it breeds on the coast of Norway, if not in Sweden also; but they have only just begun to know *A. brachyrhynchus*, and I suspect most if not all of the geese breeding on the Norwegian coast belong to that species. It seems, however, to breed in certain parts of Central Europe, and undoubtedly in Turkey (Simpson), and also Spain (Saunders). Its occurrence in *England* is now rare.

No. 2. *A. segetum*, with which I also unite *A. intermedius* and probably *A. arvensis* of Naumann, comes to England as a regular winter visitor, but is not so common as the next species; the *A. segetum* of Naumann (Naumannia, 1853) is I believe *A. brachyrhynchus*. I only know of Lapland as a breeding place of this species. The *A. paludosus* of A. Strickland (his *A. segetum* being also *A. brachyrhynchus*) is no doubt identical, but proof is wanting that it ever bred in this country.

No. 3. *A. brachyrhynchus* is the commonest winter goose in England, arriving often in August. It breeds in Iceland (Ibis. 1864, p. 132), Spitzbergen (Malmgren and Newton), north Norway (Ibis. 1869, p. 226), and I suspect all the way down the Norwegian coast to Trondhjem. Besides the synonym *A. phœnicopus*, Bartlett, I believe it to be *A. segetum* of Naumann and A. Strickland.

No. 4. *A. albifrons* breeds in Iceland (A. N.), but I do not know where else—certainly not in northern Scandinavia. In Holland they have breeding *A. pallidipes*, De Selys, which I take to be a *feral* race of this bird, or perhaps a cross between it and *A. ferus* (*cinereus*); but it is doubtful to me how far it can be called wild there. It has the very white front of *albifrons*, but is larger  
1871.]

and with the legs of *A. ferus*. *A. albifrons* occurs every winter and sometimes numerous in England. .

No. 5. *A. erythropus*. I first showed the identity of *A. minutus* with the bird originally described by Linnæus (P. Z. S., 1860, June 26). Except *A. segetum*, it is the only goose that breeds in the interior of Lapland, and it seems also to breed a good deal to the eastward—in Russia, for instance. I do not know of any instance of its occurring in England, but apparently they catch it occasionally in Holland. Saunders has seen it in Italy (Ibis. 1869, p. 395), and I think some one met with it on the Nile.

\* \* \* \* \*

Yours, very truly,

ALFRED NEWTON.

ELLIOTT COUES, Esq., M. D.

APRIL 4, 1871.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-two members present.

MR. THOMAS MEEHAN, referring to the two-leaved division of *Pinus* of Gray's *Manual*, said that *Pinus mitis* was especially named as having sometimes three leaves in a fascicle; but in two others of that section, *P. inops* and *P. pungens*, he found the so-called leaves in threes almost as abundantly as in the former one. But the chief interest was that in all three species the three-leaved bundles became more numerous as the growth of the season approached its end. In many instances the fascicles just beneath the terminal buds were mostly in threes, and in those cases, where a second wave of growth had occurred, the terminal fascicles were almost wholly in threes. He thought that these indications of order in their production might eventually lead to the discovery of the plan on which the fascicles were produced. It would, at least, appear that in all two-leaved fascicles the germs of three were present, and that it depended on some varying phase of growth whether they were all developed or not.

Mr. M. also said, in regard to the *Acer rubrum*, that he had examined a large number of trees this season in order to test definitely whether there was any difference between the brown-flowered form and the darker one, that had hitherto escaped the attention of botanists. He found that there was no difference, but that as a general rule the brown ones were male; and it was the brown filaments which gave them this color. There were, however, occasional trees of both sexes which favored either color. But he found that there were no truly hermaphrodite flowers amongst them, and therefore the description of the books, "polygamodiceous," was not strictly correct. In many female trees there were apparent stamens, but the filaments were almost wanting, and he had been unable to find any of the anthers which they bore, polleniferous. These abortive stamens hardly extended at any time beyond the minute petals; while the true stamens in the male flowers had filaments extending a half inch or more beyond the petals. He suggested that the fact of the apparently hermaphrodite flowers in *Acer rubrum* being really pistillate was perhaps a small matter in itself; but it would have much interest to those who were observing how numerous were the species which fell in with Darwin's discovery, that many plants took especial pains to avoid self-fertilization.

APRIL 11.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-eight members present.

The death of Prof. Constant Duméril, of Paris, was announced.

A paper was presented for publication entitled—

“Morphology of the Carpellary scales in *Larix*.” By THOMAS MEEHAN.

APRIL 18.

Mr. VAUX, Vice-President, in the chair.

Twenty-nine members present.

PROF. LEIDY made the following remarks on some extinct turtles from Wyoming Territory:—

Several species of extinct turtles from the tertiary deposits of Wyoming differ from those previously described by me from the same formation. They are indicated by imperfect, though sufficiently characteristic, remains, sent to me by Dr. J. Van A. Carter, of Fort Bridger; and by others obtained during Prof. Hayden's exploring expedition the last year.

ANOSTEIRA ORNATA.—One of the turtles is founded upon a number of isolated plates and fragments of others of the carapace of about four different individuals, obtained from Church Buttes and Grizzly Buttes, Wyoming. The specimens are mainly marginal, including two pygal plates. The latter are remarkably thick at the fore part, where they are hollowed into a concavity directed



while the rounded tuberculous condition is more obvious above. In two marginal plates, conspicuously tuberculated above, the lower surfaces are perfectly smooth. These probably pertain to a different species. None of the plates exhibit scute impressions, generally so evident in the emydes.

*Anosteira ornata* was almost the size of the palm or middle hand. A pygal plate measures about eleven lines in length and breadth; and its height or thickness in front is seven lines. Another plate from a younger animal measures about seven lines long, eight broad, and four lines thick in front.

HYBEMYS ARENARIUS.—The second turtle, almost as large as our common *Emys picta*, is founded on two specimens obtained by Prof. Hayden from a tertiary formation on Little Sandy Creek. They consist of a marginal plate and the portion of a costal plate. The bones are proportionately thicker than in our common emydes, but like them are smooth and deeply impressed by the scutes.

The marginal plate appears to be the ninth of the series. From the groove of the costal scute impression it is directed quite as abruptly outwardly as in any recent emys. Its peculiarity, upon which I have founded the genus, is a striking character. The surfaces, separated by the groove of the marginal scute impressions, present each a half circular boss at the fore and aft borders of the bone. Thus from this specimen we may infer that the margin of the carapace was ornamented with a series of hemispherical bosses, each of which was situated in the position of, and divided by the sutures of the marginal plates. The breadth of the specimen fore and aft and transversely is half an inch.

---

APRIL 25.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-nine members present.

The resolution to amend Art. 2, Chapter XI., of the By-Laws by the addition of the following words: "If there is no quorum at these meetings then the election may be held at the subsequent meetings," having been approved at two preceding meetings for business, was finally adopted.

The deaths of Mr. Benjamin Marshall and Prof. Charles M. Wetherill were announced.

The following gentlemen were elected members: H. Crawford Coates and B. F. Quimby.

Professor Marsh, of Yale College, made a communication on some new reptiles and fishes from the Cretaceous and Tertiary formations. Nearly all the specimens described were discovered by the Yale College scientific party during their explorations in the Rocky Mountain region last summer.

1871.]

Among the specimens from the Cretaceous exhibited were portions of a skeleton with the caudal series complete of a new species of *Clidastes*, about the size of *Clidastes propython*. The anterior caudals were elevated, and the diapophyses extended back to about the twenty-fourth vertebra with chevrons. The tail was extremely attenuated, as there are in the series eighty-one vertebrae with chevrons, the terminal ones being less than one-twelfth of an inch in diameter. The muzzle in this species is less pointed than in *C. propython*. The remains were found in the Cretaceous of Kansas, and the species was named *Clidastes Wymani*.

A second and very diminutive species of the same genus was represented by portions of the skull and teeth, with the quadrates, and several cervical vertebrae. The species was considerably smaller than *C. propython*, and differed essentially from that species in several respects, especially in the quadrate, which had the postero-superior process terminated by a short compressed hook. The teeth were smooth and nearly round at the base. This species, which was also from the Gray Shale of Kansas, is the smallest known mosasauroid, and was hence named *Clidastes pumilus*. Another new Cretaceous reptile was indicated by two teeth, which were found together in the middle marl bed at Birmingham, New Jersey. They apparently belonged to a Crocodilian, probably allied to *Hyposaurus*. One of the teeth, apparently from the anterior part of the jaw, is long, pointed, nearly round, and covered with strong angular but smooth ridges, except just at the apex, where they disappear. The posterior cutting edge is sharp and prominent, and extends the entire length of the crown. The anterior edge is only distinct a short distance near the apex. The second tooth has the crown short and compressed, with irregular ridges, and resembles somewhat the posterior teeth of *Hyposaurus*. These specimens indicate a species considerably larger than *H. Burt* and much smaller than *H. latidorsalis*.

others. It had slender jaws, a short symphysis, and rugose, striated teeth, somewhat compressed. The quadrate was constricted at its distal end, and had a sharp longitudinal ridge on its lower surface. For this species the name of *Crocodylus Grinnelli* was proposed.

The remaining reptilian fossils described by Professor Marsh were also from the Tertiary of Wyoming, and indicated several species of *Lacertilia*, some of them of large size. They belong to a new and peculiar genus of lizards, with the head and parts of the body covered with thick, highly ornamented bony plates, and hence the generic name *Glyptosaurus* was proposed. The teeth were pleurodont, and in some of the species, at least, short and obtuse. The vertebræ resembled those of *Varanus*, and the species discovered appear to all have had long tails. Four species were described which could readily be distinguished by the form and ornamentation of the cranial plates, and some of them by other characters. *G. sylvestris*, about four feet in length, had thin, nearly flat, cranial shields, with small irregular tubercles, and articular ventral scutes of the same general pattern. *G. nodosus*, about three feet long, had more convex cranial plates and thicker frontals. *G. ocellatus*, at least four feet long, had very thick articular plates, with the tubercles arranged concentrically. A much smaller species, probably two feet in length, and perhaps generically distinct, was indicated by a number of vertebræ, and jaws, and possibly by some scutes. This was called *G. anceps*.

In addition to the reptilian fossils, Professor Marsh exhibited a number of fish remains which were found in the same fresh-water Tertiary basin in Wyoming. Among these were numerous vertebræ and cranial bones, evidently belonging to the genus *Amia*, and indicating two species about the size of the modern *A. calva*. One of these species, which had the pit of the articular depression in the dorsal vertebræ considerably above the centre, was named *Amia Newberrianus*. The other species had vertebræ more nearly like the living *Amia*, but broader, and without the median groove on the lower surface of the centrum. This was called *Amia depressus*. In the same beds with these specimens numerous other fish remains were discovered, which clearly represented the genus *Lepidosteus*, and indicated two species, both having smooth scales, and about the same size as the modern gar-pike. One of these fossil species, which had unusually short vertebræ, was named *Lepidosteus glaber*. The second species, with proportionally longer vertebræ, was called *L. Whitneyi*. All the specimens exhibited belong to the Yale College Museum, and will soon be described in full, by Professor Marsh, in the *American Journal of Science*.

On favorable report of the committee, the following paper was ordered to be published:—

1871.]

PART I.—8

## MORPHOLOGY OF CARPELLARY SCALES IN LARIX.

BY THOMAS MEEHAN.

THE facts which I have from time to time contributed, verbally or in papers, to the Academy, in regard to longitudinal series of axillary buds, and adnated and free leaves in coniferous plants, will, I believe explain something of the structure of the flowers of coniferæ, which, if not quite distinct from any view before taken, will at least have reached the conclusion by an original line of argument.

I have shown that in the cases where there are longitudinal series of buds, one of the buds, and generally the upper supra-axillary one, is the largest. So far as this longitudinal series of buds is concerned, I find by extensive observation that there are very few of our American trees or shrubs which do not produce them under some circumstances, although they are more generally apparent in some than in others. In many cases they do not break quite through the cortical layer, but continue to grow from year to year, just as the wood grows, always remaining just under the outer bark. It is from these concealed but living buds that the flowers of the *Cercis*, or the spines of *Gleditschia*, will often appear from trunks many years old. In *Magnolia* and *Liriodendron* these concealed buds are easily detected by a thin

all who study this part of Botany. I find that they are not for the duplication of parts, but are separately organized from one another. Thus, in *Cratægus* and *Gleditschia*, the upper bud produces a spine, the lower is organized to grow as an axillary shoot the next season. But the best illustration of the distinctive organization is in those cases where both upper and lower buds sometimes push the same season, as in *Itea*, *Lonicera*, *Caprifolium*, or *Halesia*. Here we find that one is organized for floral organs, and the other for axillary prolongation. The upper bud always has the same function, and the lower its own, in the same species.

A flower being a modified branch, in which the bract is the leaf and the peduncle the axillary bud, it follows that the laws of axillary stem-production will be more or less reproduced in the inflorescence.

Referring now to my paper on *Adnation in Coniferæ*, we found that the true leaves of many genera in this order were adnate to the stem, forming what some botanists have termed *pulvini*, or cushions, under the fascicles of some species of *Pinus*, and that what are commonly called leaves, the "needles," are really phylloidal shoots. An examination of *Abies excelsa* will show that the upper portion of the needle has a different origin from the lower adnated portion, or pulvinus, and that in all probability it is a modification of the phenomenon referred to in *Gymnocladus*, and other plants, of a longitudinal string of buds, in which the upper is of a different organization to the lower one. In *Larix* it was shown that in the verticils, or perhaps more properly spurs or clusters, the true leaves were free, while in the elongated axis they became for most of their length adnate with the stem, forming the spatulate scales we find peel off the two-year-old wood.

At the flowering time of the Larch, the male and female flowers proceed from the termination of the spurs—not merely "of the preceding year," according to *Gray's Manual*, but in some cases of many preceding years, "the sterile from leafless buds, the fertile mostly with leaves below." (*Gray's Manual*, 5th ed., p. 472.) Why have the female flowers leaves under them, and the male none? Comparing the male and the female catkins, we see why. The scales of the male are formed out of the leaves which become fully formed in the female one. The pair of anther cells are thus simply on the back of a transformed leaf, just as we find the spore-cases of ferns borne in the same way. The weaker organization which I have 1871.]

shown in my paper, and communications on sex, permits no further development here. But in the case of the female flower the leaf maintains a separate organization all through the catkin or cone; and, as shown in my paper on the *Stipules of Magnolia*, the midrib of the leaf shortens, and, assuming a stipular character, increases in width, until we have the purple bractea so well known in *Larix*. As soon as these bractea have been arrested in their development, the carpellary scales, which answer to the phylloidal fascicles of *Pinus*, commence their growth in most species of Larch, finally equalling the bracts in length.

Whether or not the ovules which appear in the axis of the carpellary scales again result from a third longitudinal bud, I have no evidence; what I have proposed to myself in this paper is simply to show that *the scales in the male catkin of Larix are modified true leaves; while in the female they arise from buds of another organization, being the morphologized secondary leaves, or phylloidal shoots as I term them, of other coniferous genera.*

MAY 2.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-four members present.

MR. THOMAS MEEHAN exhibited some flowers of the *Magnolia purpurea*, which were much curved toward the apex, and said that this curvature was always towards the north when the flowers opened in the full sun. This had always been a subject of speculation with him, as the tendency of growing vegetation was usually towards the south, or towards the greatest source of light. This season he has had the opportunity of examining many hundred, and almost all were due north; a few were either a little west or east of north. The plants bearing these flowers were low, and the sun had full power on all the opening blossoms. That this northern tendency of the curve was, however, due to the sun, was evident from the fact that when growing under the shade of trees, the flowers of this plant were perpendicular, and of uniform growth all round.

This season he believed he had found the explanation. He observed the same curving towards the north in the expanding male catkins of *Salix caprea*. These, so long as elongation continued, were perpendicular; when this ceased, the stamens developed first on the warmest side, the side next the sun. The growth of these expanding stamens was very rapid; and he had observed that this growth not only was towards the light, but the growing parts had the power of *drawing part of the axis to which it was attached with it*. A very small rise in the temperature was sufficient to excite growth in the willow, and the difference between the sun striking against the south side of the catkin, and the heat which could be commanded by the north side, made a difference of several days in the expansion of the stamens on the respective sides. Sometimes a catkin would be formed on the north side of the plant, in the shade of the tree, in which case the most heat coming from the north, that side of the catkin would expand its stamens first, but slowly. In this case there would be a slight curve towards the south. In the case of curved catkins, the curve was always greatest after a hot burst of sun, when the stamens grew most rapidly. When the northern side developed, the axis curved back again, so that the ultimate direction was perpendicular, as it was in the beginning.

The growth of the flower of magnolia being comparatively slower, did not furnish the same evidence in detail; but the results were the same, and no doubt were influenced by the same law. The flowers curved to the north while expanding; but after a few days of full opening the north side caught up, and the flowers were

1871.]

finally erect, as in the case of the willow catkin. He thought we might safely conclude from these facts that vegetation not only grew towards the light, but exercised at the same time a lifting force which we had not before recognized.

He believed no explanation had ever been given that was generally accepted as to the curving of many kinds of pine-cones. Possibly the facts now offered might furnish the key.

Mr. Meehan then exhibited some expanding buds of *Fraxinus quadrangulata*, and showed that they had *no bud-scales* as other species of ash had. These other species had two pairs, the outer broad and somewhat thin, and which underwent little change in spring; the other and inner often grew into a short succulent sub-petiole. In the *F. quadrangulata*, at the termination of its full growth, instead of the usual broad scales, there were but minute black specks, which in the spring grew out into fully developed leaves. The buds of this species of ash were, therefore, "naked" buds. He had under his observation only one tree of this kind; but he took it for granted it was the usual condition of other trees of the species.

On his grounds were many hundred of *Fraxinus excelsior*, and he noted this season a large number of them, of which he exhibited specimens, that had the same characteristic buds as in the *F. quadrangulata*. Examining further, he found that in all cases of this kind the buds terminated second growths of last year. In all other cases, where the normal solitary cycle of growth was all that was made, the usual broad bud-scales were present. Thus we arrived at the important conclusion that a law which operated with sufficient uniformity in the case of *F. quadrangulata* to constitute a specific character, existed only in special cases in another species. What that law is, he thought yet unknown. To most persons it would be a sufficient answer to say, it was the *late*

achenia were but the remains of other flowers which had been absorbed by the central and stronger one in an early stage of their existence, and by this adnation had become an integral part of the structure of the flower.

He had now to exhibit to the Academy a small plant of this species, which had grown in a pot in his hot-house during winter, and which was in flower, and not only exhibited this fact better than the specimens he had brought to the notice of members last year, but also presented some other very remarkable phenomena. Here was a regular gradation of true horns down to an entire separation from the central achenium, in which case these detached horns bore the usual twin pistils, or rather elongated stigmas. But what was remarkable in this case was that beneath all these normal and abnormal pericarpia some small bulbels issued from the stem, and these also had stigmas more or less perfectly developed.

The whole plant, he observed, was in many respects a curiosity, which would rival the art-produced Japanese dwarf. Here was a plant a little over an inch in height, which, at the second node above the cotyledons, commenced to produce female flowers. There were no male flowers. Indeed, it was not impaired nutrition which gave it its dwarf character, for the soil in which it was growing was very rich, and the bright green color of the plant was opposed to all idea of starvation.

Another suggestion occurred to him in connection with the little plant exhibited. The ambrosia was the common rag-weed of our cultivated ground. When such plots of ground were put down into grass, no more of this weed appeared; yet, though this ground remained in sod an unlimited number of years, when broken up the ambrosia always appeared in immense numbers. Though we know that the seeds of this weed, preserved as ordinary garden-seeds are, will only live a season at best, yet all farmers and many good botanists believe that the plants spring from seeds of the crop which ripened many years before, and which have retained their vitality through all the period. But if such pigmy plants as these can perfect their seeds, we see at once how hundreds can exist amongst the grass and other vegetation, thus perfecting seeds and perpetuating themselves year after year successively, fully accounting for the appearance of plants on the subsequent breaking up of the sod, without resorting to a mere imaginary theory of wonderful vitality.

MR. GENTRY directed attention to the fact that *Alyssum calycinum*, Lin., a native of Europe, was growing abundantly on the western side of the Mt. Airy water-works, near the city, where it appears to have permanently established itself.

MAY 9.

The President, Dr. RUSCHENBERGER, in the chair.


Twenty-four members present.

The following paper was offered for publication:—

“Notes on the Natural History of Fort Macon. No. 2.” By ELLIOTT COUES.

PROF. LEIDY said that he had just received, from its author, Mr. Mason, a copy of an abstract from the proceedings of the Asiatic Society of Bengal, for June, 1871, giving an account of a case of polydactylism in a horse from Bagdad. In this case the usual “splint-like rudiments of the metacarpals of the fourth toe in the fore feet had given rise to an additional toe provided with three phalanges, of which the last is incased in a hoof.” A preparation of the foot of a horse, preserved in the Museum of the University of Pennsylvania, exhibits a similar condition. The abnormally developed metacarpal has the toe with two phalanges, of which the last is inclosed in an irregular hoof. If there were a corresponding development of the metacarpal on the other side of the preparation, the foot would represent the normal condition of the tertiary horse *Hipparion*. If both outer toes were still better developed in relation with the intermediate one, the foot would represent the condition of the earlier tertiary horse *Anchitherium*.

PROF. COPE demonstrated some anatomical points of importance in the classification of some of the Siluroids of the Amazon, noticing first those which have no swimming-bladder, but having the post-temporal bone pierced in a sieve-like manner, forming minute tympana; these he characterized as “*Oboeatus*.”



very numerous and very abundant in species, and seem to exemplify the views of Prof. Cope in a remarkable manner. Take, for instance, the *Orthis* family, one of the most common and prolific both in respect to individuals and species. In this family are five or six well-marked genera, and yet the specific characters, so far as they are discernible in the hard parts, are often quite identical in species of different genera; and though they have often varied, yet sufficient constancy is maintained to deceive any careless investigator, and to give the idea of specific identity. It is fairly to be inferred from a study of this class of fossils that generic and perhaps higher characters may change very rapidly, while specific ones are changing but slowly, nor remaining constant.

---

MAY 16.

Dr. CARSON, Vice-President, in the chair.

Twenty-three members present.

*Remains of Mastodon and Horse in North Carolina.*—PROF. LEIDY exhibited two photographs, received from Prof. W. C. Kerr, State Geologist of North Carolina, representing some remains of *Mastodon americanus* found in that State. One of the specimens represented is that of the greater part of the lower jaw of a mature male, retaining both incisor tusks and the last two molar teeth. The latter, with their angular lobes separated by deep angular and nearly unobstructed valleys, are quite characteristic of the species. The incisors are an inch and three-fourths in diameter. The last molar has four transverse pairs of lobes and a well-developed heel. The penultimate molar has three transverse pairs of lobes. The specimen was obtained from gravel overlying the miocene marl near Goldsboro', Lenoir Co., N. C. An isolated last lower molar of the same species, represented in company with the jaw, was obtained in Pitt Co.

PROF. LEIDY also exhibited a specimen of an upper molar tooth, which Mr. Timothy Conrad had picked up from a pile of miocene marl at Greenville, Pitt Co., N. C. He suspected, from its size and intricacy in the folding of the enamel of the islets at the middle of the triturating surface, that the tooth belonged to the post-pliocene *Equus complicatus*, and was an accidental occupant of the miocene marl. It may, however, belong to a *Hipparion* of the miocene period, but the imperfection of the specimen at its inner part prevented its positive generic determination.

*Remains of Extinct Mammals from Wyoming.*—PROF. LEIDY then directed attention to what he regarded as one of the most remarkable fossils which had yet been discovered in our western

territories. The specimen consists of the greater portion of the lower jaw of a pachyderm from the Bridger tertiary formation, probably eocene, of Wyoming. It was discovered by Dr. J. Van A. Carter, of Fort Bridger, in the vicinity of that place. In the same locality were also found remains of *Palaeosyops paludosus*, and the curious turtle *Anosteira ornata*.

The jaw belonged to an old individual, as indicated by the worn condition of the molar teeth; and the animal to which it pertained was about the size of the larger Peccary. The jaw, however, is of much more robust character than in the latter. The two rami are completely coössified at the symphysis, as in recent pachyderms. The chin, or forepart of the jaw, resembles in its broad slope the corresponding part in the Rhinoceros or Peccary, but is convergent as in the Beaver or other rodent.

The forepart of the jaw is occupied by two large teeth, the features of which are such that at first glance one would think we had before us a portion of the skeleton of some huge representative of the order of Rodentia. The two teeth curve upward and forward in the same manner as in the latter, but are separated by a decided interval, which at the edge exhibits alveoli for a pair of small incisors. Hence the number of incisors appears to be four, and the large teeth are to be regarded as the lateral pair. These do not extend backward in their alveoli further than the position of the premolars, and in this respect differ widely from the condition of the Beaver and other rodents.

The form and construction of the incisors are wonderfully like in the latter animals. As in these, their forepart alone is invested with enamel, which is quite thick. They are, however, decidedly convex in front, and not nearly flat, as usual in rodents. They have been worn off in a sloping manner, not only as in these, but also laterally, so that it would appear the corresponding upper teeth were

condition appears to have had nearly the same construction as in the genera just named. It was indeed suspected from the form of this tooth that the jaw belonged to *Palæosyops*, but to a smaller species than *P. paludosus*, the forepart of the jaws of which have not been discovered. The bottom of the symphysis of the jaw under examination reaches as far back as the position of the first true molar, but in a fragment of *Palæosyops paludosus* is seen not to extend as far as the last premolar. Other differences in the corresponding portions of the jaw indicate the animals to belong to different genera.

For the curious pachyderm, first brought to our notice by Dr. Carter, the name of *TROGOSUS CASTORIDENS*, or the Beaver-toothed Gnawing-hog, was proposed.

The fossil brings to our view an animal which would appear to have pertained to the stock from which diverged the Rhinoceros and Mastodon, the Peccary, and perhaps the Beaver.

Measurements of the fossil are as follows: Length of jaw from back of last molar to fore edge of symphysis, 4 inches 10 lines; depth of jaw below true molars, 1 inch 8 lines; depth of symphysis, 2 inches 8 lines; thickness of jaw above base, 10 lines; length of molar series from position of large incisors, 4 inches; length of true molar series, 2 inches 7 lines; space between large lateral incisors, 4 lines; fore and aft diameter of large incisors,  $9\frac{1}{2}$  lines; transverse diameter of the same, 6 lines.

Another interesting fossil, discovered by Dr. J. Van A. Carter in the same locality as the former, is the portion of the ramus of a jaw of a carnivorous animal about the size of the Gray Fox. The specimen contains two teeth, apparently the last premolar and the sectorial molar, behind which are portions of two other teeth.

The last premolar is larger than in the Gray Fox, and is larger than the succeeding tooth, being both wider and higher. The principal cusp exhibits a feeble denticle in comparison with that on the back border in the Gray Fox. The heel of the crown is proportionately better developed than in the latter, and presents a fore and aft acute edge, from which the sides slope to the basal ridge.

The carnassial tooth is less in size than the tooth in advance. The crown has the same general form as in the corresponding tooth of the Foxes and Weasels. The forepart or sectorial portion of the crown is less well developed than in the Fox, and the inner cusp is half as large as the principal one. The notch of the sectorial border does not end in a cleft, as in the Fox. The heel or back portion of the crown is nearly half the breadth of the latter, and it includes a concavity bordered by a horseshoe-like ridge, as in the Weasels.

The next tooth is rather larger than the one described, and is inserted by two fangs. The forepart of the crown is broken away; the back part has the same form as in the tooth in advance. This may also have been a carnassial tooth.

1871.]

The last tooth, the smallest of those in the jaw specimen, was also inserted by a pair of fangs. Its crown is broken away.

The animal indicated by the jaw fragment appears to have held a position intermediate to the musteline and canine families. It was proposed to name it *SINOPE RAPAX*, the former name, according to Prof. Hayden, being that applied by the Blackfoot Indians to a small Fox.

MR. THOMAS MEEHAN exhibited a specimen of *Achillea millefolium*, in which an underground stolon of an *Agrostis* had penetrated, and referred to a similar case, to which he had called the attention of members last year, where a *Triticum* had penetrated through large tubers of potatoes. He remarked at that time on the peculiarity of the growing force of plants which would rather endeavor to push directly through an obstruction, than turn to one side out of its straight course. He thought the present instance still more remarkable, as the living stem of *Achillea* was little thicker than ordinary brown thread, yet the grass had cloven it directly in halves in a manner we could scarcely imitate with a needle.

He then presented a quantity of sprouting peach-kernels, in order to call attention to the great variety of form which existed in the cotyledons. The most usual was ovate, the apex and base both regularly tapering, but some were obtuse—occasionally almost square—at the apex; while others were so lengthened out at the base as to give to the cotyledon a spatulate form. Others were cordate at the base, some more with the base of the lobes spurred, and others again which were simply gibbous on one side. We were, he said, all familiar enough with the fact of great natural variations in foliar and floral organs, but he believed no great differences in cotyledons have been exhibited here.

But he thought there prevailed a still greater interest in the lobes of the seed of cotyledons. It was very common to find

was by no means uncommon for the common morning-glory (*Convolvulus purpureus*, L.) to have three cotyledons. In Coniferæ the numerical variations were well known.

Amongst the peach cotyledons was one in which the radicle, with numerous branching fibres, had pushed several inches beneath the integuments, and coiled themselves about the cotyledons. The interest here was, that this had evidently taken place, before the seed had quite finished its growth in the fall, as there were grooves all along the surface of the cotyledons which indicated that they had rather grown around the fibres, than that the latter had forced their way through after the cotyledonous growth had been completed.

Mr. Meehan further exhibited two stalks of a *Lilium candidum*, the common white lily, grown in a greenhouse by Mr. W. C. Strong, of Brighton, Mass., which, instead of the usual flowers, had each terminated in two large scaly bulbs, one inch, and one and a half inches in diameter, precisely similar to those produced underground. In the ordinary growth of this lily, the spring leaves, which started from the scales, were broadly ovate, not long and narrow as the stem leaves were, and in these terminal stem-bulbs the broad leaves terminated the scales in the same way, giving the flower-stems a peculiar coronetted appearance. He explained a difference in the bulblets we often find in some lilies, and true bulbs, in this, that bulblets form in the axils of the leaves; and while the scales of the true bulb were simply dilated and succulent leaf-stalks. They had no axillary buds visible. These axillary buds were, however, really formed, but were absorbed by the leaf structure, as he had shown in past times was the case in *Cassia marilandica*, when accounting for the gland on the petiole of that plant. In the case of the lily, however, the bud, though absorbed, did not wholly lose the power of development, for though, if suffered to remain on the parent stem, scales, absorbed buds and all, usually died away, yet if these scales were removed so that the matter stored in them was not absorbed by the growing flower-stem, the latent bud in the scale would develop itself into a bulblet, which the next year would become a bulb of the ordinary character. It was in this way that the lily was now so extensively propagated by commercial florists.

---

MAY 23.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-eight members present.

The following papers were presented for publication:—

“On the fishes of the Ambyiacu River.” By Edw. D. Cope.

“Descriptions of new species of fossils from Ohio and other western States and Territories.” By F. B. Meek.

“Contributions to Orthopterology.” By Prof. C. Thomas.  
1871.]

PROF. LEIDY directed attention to some remains of *Palaeosyops*, recently received from Dr. Joseph K. Corson, U. S. A., who discovered them at Grizzly Buttes, near Fort Bridger, Wyoming Territory. They were more complete than those from which this curious tapiroid animal was first characterized, and mainly consist of portions of several lower jaws.

The specimens exhibit teeth, and fragments and traces of others indicating, at least, a series of six molars, which approached so closely the position of a large canine tooth, as to indicate that little or no hiatus existed between the former and the latter. The back portion of the lower jaw is broad and deep as in the *Tapira*, and a deep concavity occupies a position externally in advance and below that of the condyle. The body of the jaw is thick and strong, with a thick convex base. The bottom of the symphysis appears hardly to have reached the position of the anterior premolar.

The lower true molars are like those of the *Palæotherium*, *Anchitherium*, &c. The outer portion of the corresponding upper molars likewise resembles that in the genera just named, but the inner portion is different. The antero-internal lobe is a low cone with a base expanding so as to occupy two-thirds the inner portion of the crown. The postero-internal lobe is trilateral. The last upper premolar has the crown composed of an outer pair of conical lobes, and a single larger inner cone. The last lower premolar is like the succeeding true molars. The lower penultimate premolar has the anterior lobe of its crown proportionately more, and the posterior lobe less, developed than in the succeeding teeth. The series of the lower true molars measures  $3\frac{3}{4}$  inches; the depth of the jaw below the interval of the second and last true molars is  $2\frac{3}{4}$  inches. The last lower molar measures 19 lines fore and aft. The second upper true molar is  $16\frac{1}{2}$  lines transversely and fore and aft. The last upper molar is about 19 lines fore and aft

order was that of opposite leaves, only that on one side of the node, instead of the opposite leaf and axillary bud, the whole had been developed into a tendril, thus giving the appearance of an alternate-leaved structure. This appeared the more probable as the Phyllotaxis was in the half arrangement so common in opposite-leaved plants. But the appearance of the tendril, as in this case, could scarcely be deemed possible under this view, and it might be that the tendril really belonged to the leaf system opposite, as we saw it in *Cucurbitaceæ*, *Passifloraceæ*, &c., only that it had become twisted around on the opposite side. We saw this tendency in *Cucurbitaceæ*. Instead of being exactly over the leaf axil as in *Passifloraceæ*, it was twisted so as to extend one-third the way round the axis in *Cucurbitaceæ*, and it might, therefore, get half-way round in the grape-vine and other vitaceous plants. But he simply made this as a suggestion. He thought that at any rate the appearances of the tendril in this instance might be of service to those who were studying the morphology of tendrils in this tribe of plants.

The death of Mr. Stephen Morris was announced.

---

MAY 30.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-two members present.

The report of the Biological and Microscopical Section for January, February, March, and April was received.

The following gentlemen were elected members: Wm. Campbell Gatzmer, and Samuel P. Wetherill.

On favorable report of the committees, the following papers were ordered to be published:—

NOTES ON THE NATURAL HISTORY OF FORT MACON, N. C., AND  
VICINITY. (No. 2.)

BY ELLIOTT COUES.

As the identification of the Fishes and Insects that were collected seems likely to be delayed, our "Notes" are continued<sup>1</sup> with lists of the Crustacea Decapoda, and of the Shells, mostly marine, as well as of a few other marine Invertebrates.

CRUSTACEA DECAPODA.

The identifications of most of the species were made by Prof. S. I. Smith, of the remainder by Dr. Wm. Stimpson. The majority of the specimens referred to, including all those taken with the dredge alone, were collected by Dr. A. S. Packard and myself.

*Libinia canaliculata*.

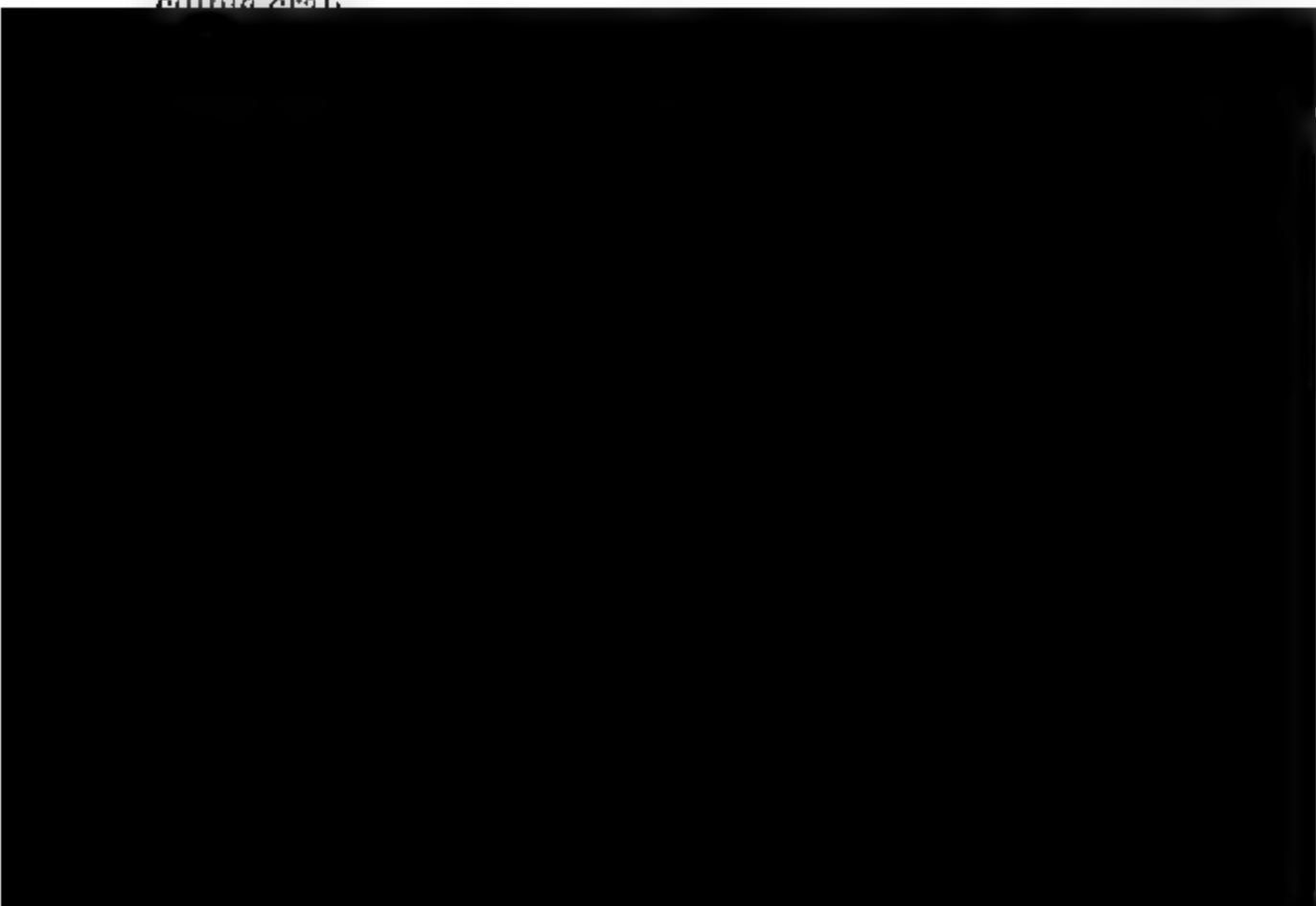
Dredged in various parts of the harbor, and found common on Bird Shoals. (*Cf.* Streets, these Proceedings, 1870, pp. 104-5.)

*Cancer irroratus*, Say.

Beach and elsewhere.

*Menippe mercenaria*. "Stone Crab."

Common, and highly esteemed as an article of food. It is much less generally distributed than, not so abundant as, the common edible crab.



*Achelous gibbsii*.

*Achelous depressifrons*.

*Arcæus cribrarius*, Dana.

*Sesaima reticulata*, Say.

*Sesaima cinerea*, Say.

*Gelasimus pugilator*, Latr.

*Gelasimus minax*, Lec.

*Gelasimus pugnax*, Smith.

The fiddler crabs occur in immense numbers throughout the marsh, and the muddier banks of the harbor. The three species given above were taken together, and appear to associate indiscriminately. They form a considerable part of the food of various birds, especially the herons, rails, gulls, fishcrows, and grackles, and many are destroyed by the larger crabs, as the Stone, and the common edible species. They may be found at all seasons, but are much more numerous during the warmer months than in winter, when, however, some are seen abroad; and they may always be taken by digging into their holes. Of their numbers one who has not seen them can form no adequate estimate: they gather about decaying substances until the ground for several square yards may be completely covered; and troops running through the scant herbage of the marsh make a rustling sound. They doubtless exercise great influence upon the natural economy of the localities they frequent, in devouring decomposing matters, both vegetable and animal. They swim with ease, but in general avoid the water, and appear to prefer rather dry and sandy places to the heaviest mud. This preference is especially marked in the selection of places for boring the holes; this is done chiefly, I think, during the night, at least I do not remember to have seen the animals so engaged; and frequently places I had walked over the day before, when there had been no holes seen, were riddled through in the morning. The holes average in diameter little over half an inch, and look exactly as if punched by the end of a walking-stick; they are sunk at all angles with the surface, are oftener tortuous than straight, and generally a foot, or less, deep. Little piles of sand near the entrance show the fresher excavations, as they are soon levelled by natural causes. The tunnels are

1871.]

probably at first the exclusive right of the individual digging them, but the proprietorship is not observed, at least on an occasion for alarm, when the crabs tumble promiscuously into the nearest one, often with struggle for precedence; and it is particularly amusing to see some large individual, caught away from his own habitation, stick in a hole too small for him, or try several such in desperate hurry. I noticed that the animals went in either side first with equal facility. Without alluding to what may have been the specific characters used to separate the above species, I should judge that specimens incontestably the same varied indefinitely in coloration. The great claw of the larger individuals is sufficiently strong to bring blood from the finger. Although pretty active, they are much less swift-footed than the next species, and may be easily captured by hand. The only use to which I knew of their being put, was to bait hooks for fish, for which purpose they are well adapted, being greedily taken by sheepshead, sea-trout, and other smaller kinds.

*Ocypode arenaria*, Say.

While the preceding kind is confined to the marsh and adjoining soil, the sand-crabs are equally restricted to the beach and the clean dry sand of the dunes, there forming one of the most conspicuous features of the locality. Although they do not occur in such immense numbers as the fiddlers, they are numerous enough to act as efficient scavengers in their own territory; and, particularly during the summer months, hundreds may be seen in a few minutes' walk. At times they gather in troops of considerable

spade. The holes are usually just large enough to admit the hand a little way, and pass in every direction downwards; may be straight or tortuous, and from a few inches to a yard or more in depth; two or three feet may be an average excavation. Usually the sand is heaped up about the entrance, and forms quite a conspicuous mound. It is apparently simply pushed out in most instances; but in one instance that I examined with particular care, this was not the case. The hole was in perfectly dry and drifting sand, and all around, at varying distances, from a foot to over a yard from the entrance, lay little separate piles of fresh wet sand brought up from below; a different set of tracks leading to each heap. This showed that the animal had repeatedly brought up an armful of sand, and dumped it at some distance. The holes, I may add, are almost invariably placed above ordinary high-water mark, mostly in the flat dry shingle separating the beach proper from the adjoining sand-drift dunes. A small proportion of the crabs live in the sand-drifts still back of this, and a few others come about the houses near the fort, digging in odd corners, and to all intents and purposes replacing the house-rats. Their remarkable swiftness of foot is well known; and when brought to bay, their pugilistic attitudes and actions are as noticeable as is the sly cat-like aspect they present when crouching closely, in hopes the intruder will pass them unnoticed, or in lying in wait for prey. The large claws are of porcelain-like whiteness and hardness, and capable of inflicting a wound not to be overlooked in a moment; but the general covering is so soft that the animals are disabled, or even killed outright, by being simply dropped upon the hard sand from the height of a man's head. The young, which are at first spotted, and bear little resemblance to the adults except in shape, begin to appear in the latter part of April; and they are an inch or more wide before they begin to assume the general dull yellowish color of the adults. These crabs are put to no use, except to afford excellent sport to boys and boyish men, who bait them with their canine companions.

*Pantheres ostræum.*

The oysters furnish the usual numbers.

*Purpura punctata.*

Common, on the sand-bars, &c.

*Hepatus decoris*.

Dredged, and found on the beach.

*Hepatus angustatus*, White?

*Hippa talpoides*, Say.

Very common, in sheltered portions of the sandy shore, the sand-bars, clear tide pools, &c. They often gather in large numbers in the pools among the stone jetties along the beach, actively swimming about in a manner that forcibly recalls the similar sports of the *Notonectes*, and burying themselves in the sand with remarkable speed. Females with eggs were taken early in May.

*Eupagurus pellicaris*, Stimp.

*Eupagurus longipes*, Stimp.

These two hermits are found in every locality about the harbor, except it be, perhaps, along the open beach, and in the muddiest parts of the marsh. They were dredged in the deepest portions of the channel, and are numerous in the tide-pools along the shore and on the sand-bars. The smaller species is much the most abundant, and finds ample accommodation in *Nassa obsoleta*, of which there are thousands dead everywhere, *Littorina*, and shells of similar shape; the other is usually taken in young *Busycons*, *Fasciolaria*, and the *Cancellaria reticulata*.

*Palæmon vulgaris*, Say.

(? *Palæmonopsis carolinus*.)

## ENTOMOSTRACA.

***Limulus polyphemus*.<sup>1</sup>**

Common, but much less abundant than further north. It may be taken at any season, but is especially numerous in May, when it resorts to the shoal water about the harbor to spawn. About the middle of this month hundreds were noticed on Bird Shoal, these mostly copulating or seeking to do so; and all the females examined were laden with eggs. One specimen taken presented a curious monstrosity, having the tail bifurcated at the extremity for over an inch. One of the forks was rather smaller than the other, and stood out more obliquely from what appeared to be the proper termination.

## CIRRHIPEDIA.

***Balanus oburneus*?**

In profusion, on all hard submerged objects.

Two other species of cirrhipeds occur, chiefly, it would appear, on wood, &c., that has floated from some distance southward.

## ANNULATA.

BRACHIOPODA.<sup>2</sup>***Lingula pyramidata*, Stimp.**

This animal can be procured in any desired numbers, with little trouble, in a particular part of the harbor. After numerous trials, the best place was found to be the southern side of Bird Shoals (side next the fort), and in a straight line between the flagstaff upon the fort and the large building at the eastern extremity of

<sup>1</sup> On the development of this animal, see Lockwood, S., "A Contribution to the Natural History of the King Crab," read October, 1869, N. Y. Lyc. Nat. Hist.; and "The Horse-Foot Crab," Am. Nat., IV., July, 1870, p. 257; and A. S. Packard, jr., abstract of a paper read before the 19th meeting of the A. A. A. S. in the Am. Nat., IV., October, 1870, p. 468.

<sup>2</sup> Mr. E. S. Morse's discussions of the position and relations of the group, as "a division of *Annelida*," which have attracted so much attention, will be found in the Am. Nat., IV., July, 1870, p. 314; Am. Journ. Sc. and Arts., 1870, (abstract from Pr. Bost. Soc. N. H.); Am. Nat., IV., Oct. 1870, p. 493 (abstract from Proc. of 19th Meeting of A. A. A. S.). An abstract of a paper by W. H. Dall in the same number of Nat., p. 510, gives an opposite view of the case. Prof. W. C. Kerr (abstract of a paper in Am. Nat., Nov. 1870, p. 571) ascribes the origin of the Carolina phosphates to *Lingula*.

1871.]

the town of Beaufort. This is a solid and apparently nearly stationary part of the shoals, where the sand is somewhat packed and matted with a scant growth of some marine grass. No specimens whatever were found, although carefully sought for, in more exposed and shifting parts. As the shoal is flooded over with two or three feet of water at high tide, and the animal lives only about at or below low-water mark, it can be gathered only during an hour or two when the tide is fully out. They will be found a few inches below the surface, and may readily be procured by the expedient devised by Mr. Morse, of digging up spadefuls of sand, and sifting it through a coarse sieve held partly under water. It will be found most convenient to wade into the water where it is a foot or less deep, and dig there, as there is then no necessity of carrying the sieve back and forth. In this way Mr. Morse, Dr. Packard, and myself once procured over fifty in about an hour, and I several times took twenty or thirty in the same time. They should be carefully picked out from the stems and roots of the grass in which they are found entangled after sifting, and placed in a basin or bottle of water with some clean sand, where they may be kept alive for an indefinite length of time. Mr. Morse wrote me that all the specimens he took north in May, were alive several months subsequently. Other interesting specimens may be procured along with the Lingulas, in the same way; as numerous tubicolous worms, an ophiuran, *Renilla*, and the rare and highly prized *Branchiostoma*.

## CEPHALOPODA.



list, with a few exceptions, rest upon his identifications of the specimens. His critical observations are introduced between quotation marks. My own notes, though merely those of a collector, may prove of some use to future observers in this locality; their general accuracy is believed to be unquestionable.

In May, 1870, Dr. Packard and Prof. Morse visited Fort Macon, bringing a dredge; and all the species exclusively obtained with its use are among the results of our joint collecting.

The list is restricted to the species actually collected, and contains a few not previously recorded from this locality.

I cannot do better than to reproduce in this connection a part of the prefatory remarks in Dr. Stimpson's article.<sup>1</sup>

"The vicinity of Cape Hatteras, the most projecting point of our coast south of New York, has peculiar interest to the student of zoology. This Cape, which divides the Areniferous region into two nearly equal parts, the Virginian and Carolinian provinces, is remarkable for the exhibition of a fauna more tropical in character than that of either of these provinces. \* \* This is an evident result of its proximity to the gulf stream, the warm waters of which are even said to be deflected directly upon the cape after violent southeast gales.

"\* \* The harbor of Beaufort is situated at one of the southern outlets of Pamlico Sound, where it joins Bogue Sound. It is shallow, and much obstructed by extensive shoals. \* \* The bottom is generally sandy, but that of the deeper channels is shelly, and that of the shallower channels often muddy. Outside the harbor, and off the coast, the depth never exceeds eight fathoms within a few miles of the land, with a variable bottom, sometimes 'sticky' or clayey. \* \* In following the beaches, we observed a decided increase of the tropical character as we proceeded eastward toward the Cape.

"Geologists will be interested to notice the occurrence of several species hitherto only known as Tertiary fossils, such as species of *Axinæa*, *Lucina*, *Astarte*, *Amphidesma*, *Tellidora*, *Myalina*, *Panopæa*, *Entalis*, and *Columbella*. These were found either alive or in such condition as showed them to be recent shells, which would doubtless have been found alive upon further search. The occurrence of *Myalina subovata* is interesting, although our specimens

<sup>1</sup> American Journal of Science, May, 1860.

of this species, as of *Amphiderma constricta*, are not certainly recent, being only single valves. Of the beautiful *Tellinids* *bimaculata* we obtained several living examples, some attaining a length of nearly two inches. Among the shells of a tropical character several species will be noticed which have not hitherto been found north of the West Indies, and do not exist upon the South Carolina coast."

Beaufort, Fort Macon, and the Morehead Depot are nearly equidistant, and about two miles from each other. Vessels of ordinary tonnage reach Morehead by the nearly direct ship-channel, but none larger than schooners of the lightest draught can reach Beaufort, between which and Fort Macon lies a small island. The entrance to the harbor is comparatively narrow: and as a large body of water passes through it twice a day, the current in the main channel is strong. This sweeps sharply close past the projecting extremity of Bogue Banks, but its erosive action seems to be about counterbalanced by that of the S. to W. winds which almost constantly prevail, depositing sand as fast as it is removed. I can account only in this way for the permanence of this, the most exposed point in the harbor. The waters that pass through the main outlet are collected from several widely separated directions from E. through N. to W.; and this is one evident cause of the numerous shoals that now obstruct the harbor, deflecting the different currents, and increasing as well as continually varying their conflict with each other. As a result, the hydrography of the harbor is notably inconstant, and surveys



time they have been under my observation. Bird Shoals, the most extensive of these, is believed to be now cutting in two; and it will probably in time form two islands, covered with vegetation, like the "town marsh," above mentioned as now lying between Beaufort and Fort Macon. A current directly across it, in a line from Beaufort to the point of Shackleford, is already perceptible during a part of each tide.

The formation of the long, narrow islands that girt so large a portion of the southern coast, is excellently shown here. Along a considerable part of Shackleford and Bogue Banks the loose sand is blown by the prevailing off-sea winds, and heaped up to such extent, in some places, as to bury trees twenty feet high. At other points the reverse action of the elements is witnessed, in the stumps of trees, apparently cedars, that are denuded at low tide.

The general character of the shells that are so abundantly strewn on the outer beaches, may be gathered from the list; of these, as distinguished from those not likely to be procured except by dredging, the list is believed to contain very nearly all; the exceptions being chiefly such as only occur nearer Hatteras, alluded to in Dr. Stimpson's article. The abundance of fossil species found on the beach, as the several *Arcas* and others, is especially noteworthy. I should judge that nearly half the number of individual shells (not, of course, of the species) are not certainly recent. In the harbor, Bird Shoals will be found the most fruitful collecting-grounds when the dredge is not used. This is a mile or so long, by half as wide, almost perfectly fiat, alternately covered with two or three feet of water and completely exposed. The edges are loose and shifting, but most of the surface is somewhat fixed, and supports a slight sparse growth of marine plants. This portion affords the best things. A considerable proportion of the living shells of the locality may be found there. The sand is full of tubicolous worms of several different species. Several Echini, star-fishes, and jelly-fishes lie just about its edges. It is the favorite spawning-ground of *Limulus* and two or three *Busys*. An Ascidian, an Ophiuran, *Renilla reniformis*, and *Synapta* (?), are abundant. Two or three specimens of the rare *Branchiostoma* were secured in sifting for *Lingula pyramidata*; of which last, as stated elsewhere, any desired quantity can easily be procured

1871.]

In forming the present collection of marine invertebrates, every part of the harbor was pretty thoroughly explored with the dredge, which, however, was not used outside. Nearly everywhere the depth of water proved less than we had been led to expect, and the bottom freer of everything except shelly detritus. Upon the whole, the results of dredging were not in a usual ratio, in interest and importance, with those of collecting by hand on the shoals, &c. I mention this fact, which surprised us at the time, as it goes to show the changeableness of the locality. Probably some of the dredging-grounds worked over by Drs. Stimpson and Gill, in 1860, are not now such.

The following names occur in Dr. Stimpson's list and not in the present one :—

*Cynthia vittata*; *Molgula* sp.; *Ascidia* sp.; *Plicatula* sp.; *Lima* sp.; *Axinaea* sp.; *Arca cælata*; *Pinna carolinensis*; *Modiolaria lateralis*; *Lucina cribraria* and two other species; *Felania*; *Lepton lepidum*; *Astarte undulata*; *Trigona* sp.; *Venus rugosa*?; *Chione pygmæa*; *Lucinopsis* n. sp.; *Semele reticulata*; *Tellina fausta*, *versicolor*, *constricta*, T. sp., T. n. sp.; *Strigilla carnaria*; *Tellidora lunulata*; *Solen viridis*; *Saxicava distorta*; *Lyonsia* sp.; *Pholadidea cuneiformis*; *Tornatella punctostriata*; *Dentalium* sp.; *Clypidella pustula*; *Scalaria turbinata*, *multistriata*, *novangliæ*?; *Turbonilla* sp.; *Volva uniplicata*; *Mangelia rubella*, *filiformis*; *Columbella* sp.; *Nassa ambigua*?; *Cerithiopsis*? n. sp.; *Acus concavus*.

Additional ones of the present list are: *Pecten* sp. (fossil?);

## LAMELLIBRANCHIATA.

**Anomia ephippium**, Linn.

Abundant in all situations.

**Ostrea virginiana**, Latr.

Abundant, of excellent quality; worth, according to season, from 25 cents to 50 cents per bushel.

**O. equestris**, Say.

Abundant; adhering to rocks, with *Modiola* and *Mytilus*.

"Prof. Stimpson informs me that this is not a N. C. species, although it is in his Beaufort list. The specimens seem to me to agree exactly with Say's description and figure; they are short and small, with from six to twelve denticulations on the upper valve near the beak, received into corresponding depressions on the edge of the lower valve."

**Plicatula depressa**, Lam.

Frequent. Beach.

**Lima scabra**, Born.

Nos. 2615-6-7, dredged in the channel.

**Pecten dislocatus**, Say.

Abundant. All the live ones I saw were on the sand-bars and somewhat muddy flats about the harbor; the worn and variously discolored valves are strewn everywhere. The scallops bring a high price in the market; the muscle is considered the only edible part. These molluscs, and the large *Cytherea*, furnish some part of the food of the herring gulls in winter.

"Distinguished by the interrupted and dislocated colored markings from *P. irradians*, Lam., which has concentric bands of color. Some of the specimens probably belong to this last species; but all the perfect ones I examined, even though showing prominent concentric bands, display the zigzag markings, especially when placed in water, so as to bring out the colors."

**Pecten concentricus**, Say. (*P. irradians*, Lam.)

Among the interminable variations in color of worn specimens, some are pure white, or with only faint coloration in apparently perfectly regular and concentric bands.

1871.]

*Pecten nodosus*, Lam.

Apparently very rare; one valve only (No. 2584); beach, worn, in winter.

*Pecten*, sp. indet.

One specimen (No. 1687), fragment of a large species. "Probably fossil."

*Pectunculus*, probably *charlestonensis*, Holmes.

A few specimens (Nos. 1704, 2504, 2640) from the beach.

"I think there is another species, much smaller. There ought to be a good many fossil *Pectunculi*, of which eleven species are given by Conrad in his list of the miocene shells of the Atlantic slope, most of them from North or South Carolina. Living or fresh specimens would be of great interest."

*Area americana*, Gray.

Very common, beach and elsewhere, both living and dead.

*Area holmesii*, Kert.

Beach and elsewhere; very common.

"I have seen no detailed description nor authentic specimen of this species, and am uncertain whether a detailed description has ever been published. I feel no doubt, however, of the correctness of the identification" (of Nos. 2500, 49, 50, 1, 3, 4, etc.).

*Area lianesa*, Say.

Beach, frequent; all the specimens I gathered were discolored

in *occidentalis* the larger ribs are comparatively few and distant, with three or four smaller ribs between each pair."

***Arca transversa*, Say.**

"I find some small specimens that I think are this species, but am uncertain whether they are not the young of some of the others, especially as Stimpson does not include it in his Beaufort list. Kurtz, however, gives it from both N. and S. C." I should add, that Prof. Stimpson, in looking over an early lot of shells I sent to the Smithsonian, made the same identification, presumably from the same specimens that Mr. Smith subsequently received.

***Arca limula*, Conr.**

Beach, frequent. The specimens were without exception grayish or rust-colored, with a chalky appearance in places.

"Fossil? Conrad quotes it as a miocene fossil from the Neuse River, below New Berne, and from Wilmington, N. C. It agrees perfectly with Conrad's description and figure (Mioc. Foss. U. S., p. 60, pl. 31, fig. 3)."

***Arca ponderosa*, Say.**

Beach; fresh or living specimens, common.

***Arca incongrua*, Say.**

Beach; the most abundant of the genus, apparently; and, with the last, oftenest found alive.

***Arca*.**

"Numerous specimens, all I think fossil; and I have not the means of determining them."

***Nucula proxima*, Say.**

Dredged, in the channels.

***Yoldia limatula*, Say.**

Beach, occasional, and dredged.

***Leda acuta*, Conr.**

In the sand, frequent, Bird Shoals.

***Pinna seminuda* of Kurtz's list.**

Abundant. There may have been another species among the many specimens gathered, only a few of which were forwarded.

***Avicula atlantica*, Lam.**

Not common; only two specimens secured.  
1871.]

**Modiola plicatula, Lam.**

Very abundant, in the muddier parts of the marsh, below high-water mark, and thence part way out to the beach; but no live ones seen in the sand of the beach itself. In the former situations, the shells closely assimilate in color to the ground in which they are partly imbedded; in the sand, they are clearer, and show the purplish hues. The larger ones are generally found singly, anchored to bits of stick, the roots of plants, etc.; the smaller, in masses, along with *Mytilus*, adhering to flats of raccoon oysters, the stones of the wharves at Beaufort, and the jutties of rock on the beach.

**Modiola americana, Leach.**

Rather uncommon, on the beach only; none found alive, and most somewhat worn.

"Krebs gives '*M. americana* Tarvart d'Herbigny (*M. americana* Leach? *M. tulipa* Link, etc.)' and does not quote *M. tulipa* otherwise. Stimpson gives in the Check List *M. americana* (Leach), and among the doubtful species, *M. tulipa* Lam. In the Beaufort List, he gives both *M. americana* and '*M. tulipa*.'"

**Modiola castanea, Say?**

A single specimen, dredged alive in the channel.

"I have never seen an authentic specimen of this species, which Kurtz in his catalogue gives only from S. C. It seems to differ from *M. americana*, and to agree exactly with Say's description."

**Mytilus carolinensis.**

and striking variegated colors, as well as its abundance. Dead shells are strewn everywhere; and live ones (mostly young) may be found in every part of the harbor.

**Cardium muricatum**, Linn.

Beach; rather common.

**Cardium isocardia**, Linn.

Beach; common.

**Liocardium lævigatum**, Lam.

Beach; not uncommon; almost always worn, and with slate or blackish discoloration.

"*Cardium lævigatum* Lam. is given by Hanley as a syn. of *C. serratum* (Linn.), and *C. lævigatum* (Penn., and Linn?) as = *C. serratum* Lam. The first named is our species, the other coming from England."

**Liocardium mortoni**, Conn.

Dredged, and on the beach; but apparently not abundant.

**Lucina strigilla**, Stimp.

Extremely abundant everywhere; but no live ones seen. This is a favorite with the population in the vicinity for what they consider ornamental purposes—as, to paste on picture-frames, along with *Donax variabilis*, *Tellina alternata*, *Sigaretus perspectivus*, and *Scalaria humphreysii*.

**Lucina chrysostoma** (*L. radula* of Kurtz's list).

Very common, beach and elsewhere; no live ones seen.

**Diplodonta ? punctata**, Say.

Dredged.

**Astarte lunulata**, Conr.

Dredged; apparently rare.

**Cardita tridentata**, Say.

Dredged, one or two specimens.

**Mercenaria violacea**, Schum.

The representative species, and extremely common.

**Mercenaria violacea** var. *notata*.

Several specimens, among numbers of round clams indiscriminately gathered.

1871.]

*Meretaria mortoni*, Conr.

The quahogs with prominent recurved concentric laminae are common, and, so far as I am able to judge, readily distinguishable from the more usual kind. Very large specimens (five to six inches) are scattered over the sand, half buried, on Bird or other shoals, where I did not notice *M. violacea*. I have seen boat-loads brought for sale, consisting entirely of the ridged kind, and was assured that they occurred in certain localities to the exclusion of the other species. The fishermen seem to make a distinction, and certainly I saw none that I hesitated to discriminate. Young specimens (two to three inches) are quite smooth between the fewer and sharper laminae; in the largest ones the ridges become blunter and more crowded, and the whole surface is rugged.

*Gemma totteni*, Stm. (*Venus gemma*, Tott.)

Dredged.

*Chione cancellata*, Linn.

An abundant shell.

*Cythera convexa*, Say.

Strewn in numbers over the beach. Of the many examples gathered, all show gray or olive discoloration, and are much eroded.

"Fossil?" Stimpson does not give it, and Kurtz marks it 'N. C., fossil?' If fossil, the specimens are probably *C. sayana* Conrad, which he described and figured in his Miocene Fossils of the United States as identical with Say's *convexa*; but in his Catalogue of the Miocene Shells of the Atlantic Slope (Part I, N. S.

break in one valve by repeated blows with the beak—a tedious process, it seemed, in some cases that I watched. The fracture of this shell is clean, sharp, and almost vitreous.

*Artemis discus*, Reeve. (*Artemis concentrica*, Born.)

Very abundant; the dead ones, almost always with the hinge intact, are conspicuous on the beach; and some live specimens were procured about the harbor.

*Artemis*, sp. indet.

Dredged.

*Pholadiformis*, Lam.

Dead shells are common everywhere, but especially on the beach.

*Canaliculata*, Say.

Beach, very abundant.

*Lineata*, Say.

Not ordinarily common; but occasionally, after storms that seem to disturb some special situations they inhabit, they are strewn on the beach in large numbers.

*Raveneli*, Conr.

Strewn in profusion on the beach and elsewhere. Most of the worn specimens are variously discolored.

“Probably what is catalogued as *M. oblonga*, Say, by Kurtz and Stimpson.”

*Similis*, Say.

With the last; not so common.

“I find among the specimens some that I think are this, but it is a doubtful species.”

*Lateralis*, Say.

Abundant, with the first.

*Variabilis*, Say.

Very abundant; living a few inches below the surface of the sand, chiefly of the beach itself. At certain states of the tide, &c., they are in the habit of coming to the surface, and of disporting with considerable agility. They must, however, be somewhat cautiously watched, as they have a sense of observation, whatever it may be, that informs them of probable danger, and causes them

1871.]

to disappear below with a degree of celerity that astonishes one who observes it for the first time.

This species is very appropriately named. In looking at some hundreds, I have found very few alike in color. After death the valves, like those of *Dosinia*, long remain joined.

*Cumingia tellinoides*, Conr.

Dredged; apparently not common.

*Semula orbiculata*, Say.

A few specimens, dredged in the channel.

*Amphidesma constricta*? Philippi.

Dredged? (Label misplaced.)

*Abra squalls*, Say.

Common; valves on beach and elsewhere; and dredged.

*Tellina alternata*, Say.

The largest and most conspicuous, if not also the most abundant, species of the genus noticed. Valves everywhere; and dredged.

*Tellina tenera*, Say.

*Tellina tenta*, Say.

*Tellina iris*, Say.

These three species are common; *tenta* apparently less so than the two others; the specimens of it were all, I think, picked up on the beach, where both *tenera* and *iris* also occur. The two last, however, are more abundant on the sand-shoals, and in

more so on the shingle at the mouths of the estuaries that make from the marshes into the harbor, where the best specimens may be found.

**Siliquaria bídens**, Chemn.

Common, on the beach only, where all the numerous specimens were gathered.

**Solemya velum**, Say.

Not uncommon; living specimens dredged, and taken on Bird Shoals, a few inches below the surface.

**Mya arenaria**, Linn.

Not common, comparatively; occasional valves occur anywhere, but the species is not known here as an article of food.

**Corbula contracta**, Say.

Dredged; a few specimens.

**Myalina subovata**, Conr.

Dredged; a few specimens.

**Panopæa americana**, Conr.

Apparently rare; two specimens; one valve (No. 1818), very large, worn, was found on the beach, in winter; another (2494a), fresher and smaller, was taken the next winter, after one of the storms that threw up numbers of *Raeta lineata*.

**Gastrochæna**, sp.

Dredged; one specimen. I do not find the name among Mr. Smith's MSS., and think it was an identification of Mr. Morse's.

**Cochlodesma leanum**, Conr.

**Lyonsia hyalina**, Conr.

Dredged, I think (label misplaced).

**Pandora trilineata**, Say.

One specimen (No. 2618); beach.

**Pholas costata**, Linn.

Beach, very common.

**Pholas truncata**, Say.

Beach, frequent. As in the cases of several other species, I found valves quite plentiful at intervals, between which none were seen.

1871.]

## GASTEROPODA.

*Polysera* 1 sp.

One specimen, dredged in the deeper part of the channel, about an inch long, noticeable for its bright blue and yellow tentacles.

*Aplysia* 1 sp.

Two specimens of another nudibranch were taken Aug. 3, 1870, as they were floating on the surface of the water in the harbor, and the same species was subsequently several times seen. The animals were quite lively, moving about freely, especially if irritated, by a regular waving motion of the free edges of the tunic. When most contracted, they were of a flattened and somewhat irregularly oval shape, some three inches long; and were capable of stretching out between six and seven inches. Placed in water, the color appeared of a clear warm brown, pellucid-punctate all over; these whitish dots gathered in irregular patches, changing their contour with the animal's motions; when it was closely contracted, an open network of dark lines appeared all over the surface. Out of water, the whitish patches confer a general glaucescence upon a dull brown ground. The animal is tinted, especially behind, with carmine, from the deep lake-colored, viscid, glairy fluid it emits in a stream, apparently at will. Black eye-specks, distinct at the base in front of the posterior pair of tentacles. I have not the means, at present, of identifying the species, which seems to be not at all rare, but presume that it may be recognized by the above description.

**Crepidula convexa**, Say.

Common.

**Crepidula unguiformis**, Say.

Common; dead, anywhere; and alive, adhering to the *inside* of shells, such as *Neverita*, etc.

**Fissurella alternata**, Say.

Common; chiefly on the beach.

**Zisyrphinus**, sp.

Very rare; a single specimen, dead, on the beach (No. 2516).

**Turbo crenulatus**, Gm. ?

A single *worn*, incrustated specimen (No. 2595), from the beach, evidently transported from a distance.

"Exactly like Cuban specimens marked *T. hippocastaneus* = *T. castaneus* (Chemn.), which, however, I do not find recorded from our coast."

**Littorina irrorata**, Say.

Extremely abundant, in the marsh; generally seen crawling up the culms of reeds and grasses, from which they drop at a touch. During summer they are so numerous in some places, that they almost give color to the herbage.

**Scalaria humphreysii**, Kiener.

"Blood-shells," so called often, from the purplish color of the soft parts that appear at the opening. Very abundant, chiefly on the beach, where occasionally they may be found touching each other, if not heaped. The purity of color and pleasing form of this shell render it a great favorite for those peculiarly ugly fabrications called "shell-frames."

**Scalaria lineata**, Say.

Common everywhere.

**Solarium granulatum**, Lam.

**Vermetus radicula**, Stimps.

Common.

**Cerithium**, sp.

Some specimens, as 1782, which apparently Mr. Smith did not receive, were mentioned to me by Dr. Stimpson as "*Cerithium ferrugineum*?"

1871.]

*Bittium nigrum*, Tott.

*Bittium greenii*, C. B. Ad.

Dredged.

*Bittium*, sp.

Extremely abundant in the shallowest and most sluggish parts of the harbor, adhering to marine plants. On forcing a boat through beds of this vegetation, where the water hardly covered the dredge, we took scores of specimens in a few minutes; and the same haul showed the following: *Tellina tenera*, *T. iris*, *Columbella avara*, *Abra*, *Nucula*, *Corbula*, *Obeliscus*, *Turbonilla interrupta*, *Arca holmesii*, *Nassa vibex*, *obsoleta*, &c. The *Bittiums* were blackish, and covered with vegetable matter.

*Triforis nigrescens*, C. B. Ad.

Dredged.

*Odostomia seminuda*, C. B. Ad.

Dredged, in deeper waters.

*Odostomia impressa*, Say.

Dredged, with the last.

*Turbonilla interrupta*, Tott.

Beach and dredged.

*Turbonilla*? sp.

Specimens in a large miscellaneous lot gathered on the beach.

*Obeliscus crenulatus*, Holmes.

Dredged.

**Neverita duplicata**, Say.

Abundant.

**Cypræa exanthema**, Linn.

Rare; one specimen (No. 1810), a worn fragment, so identified by Dr. Stimpson.

**Pleurotoma cerina**, Ktz. and Stm.

Dredged.

**Pleurotoma plicata**, C. B. Ad.

Dredged.

**Marginella apicina**, Menke.

Dredged, and frequently found on the beach.

**Oliva litterata**, Lam.

Very common; called "Key-shells."

**Olivella mutica**, Say.

Very abundant; "Bead-shells."

**Columbella avara**, Say.

Common; beach, shoals, and dredged in various parts of the harbor. "Some are of unusually bright colors."

**Columbella ornata**, Ravenel?

Several specimens.

**Columbella lunata**, Say.

Several specimens dredged.

**Dolium galea**, Linn.

Beach, frequent.

**Semicassis granulosa**, Brug.

Common.

**Cassis cameo**, Stm.

Common; but I never saw it alive, and nearly all the specimens noticed were worn, and usually also with slate discoloration.

**Purpura floridana**, Conr.

Rare, I should judge, having obtained but few specimens—Nos. 1757 and 2588 (a broken one), and two live ones.

**Ilyonassa obsoleta**, Say.

I should judge this to be the most abundant shell of this locality, *Littorina*, even, not excepted. Myriads cover the sand-  
1871.]

shoals and mud-bars of the harbor, and the mud of the marshes, in some places so thickly that no step can be taken without treading them under foot. They may be dredged at all depths; and bleached shells are heaped in some places. Such numbers, in devouring decaying vegetable substances, must exercise decided influence in the natural economy of the locality. The dead shells of this as well as of the species of the next genus afford the most usual accommodations of the smaller *Eupaguri*. Many specimens may be found with the apex perfect; but in such cases it is usually lighter colored and more fragile than the rest of the shell, as if already devitalized.

*Nassa vibex*, Say.

Common.

*Nassa trivittata*, Say.

Common.

*Nassa* ———?

Several undetermined specimens; and others marked "*Nassa vibex*?"

*Cerithiopsis terebralis*, C. B. Ad.

Dredged, in the channel.

*Aeus dialocatus*, Say. (*Cerithium petiti*, R.)

Very abundant. The species lives mostly on the shoals and in the shallower dredgings; dead shells are found everywhere.

*Rapana* (*Fusus*) *cinerea*, Say. (*Buccinum plicatum*, Menke.)

Common on the beach and dredged in various places. The shells

tint varies from nearly white or pale delicate yellow to bright salmon-color.

*Busycon carica*, Linn.

Abundant; probably there are ten or more of this to one of the last or of the next. They are used for food by the lower classes.

This pyrula spawns in May. I have observed and taken numerous specimens with the egg-case issuing from them. At this season the females resort to the shoals covered with a foot or so of water at high tide, and exposed at other times. They bury themselves a few inches below the surface of the sand, and doubtless remain stationary during the whole process, which appears to require considerable time (not ascertained, even approximately). The case is thrust upward through the sand, and at length appears above the surface, lying exposed, and thus indicating the whereabouts of the animal. The string begins as a simple shred of the substance, two or three inches long, without proper cases. The first few cases are imperfect, smaller than the rest, and of decidedly different shape; one or more may not contain young shells. They regularly increase in size, and assume with equal regularity the perfect shape. The string is spun out to an average length of between two and three feet; the cases are largest and most closely packed at or just beyond the middle; the series generally terminates more abruptly than it began.

These egg-cases have the form of those ascribed to *Pyrula canaliculata* by Mr. Smith (Ann. Lyc. Nat. Hist. N. Y., vol. vii, p. 150), and by Mr. Geo. H. Perkins (Proc. Bost. Soc. Nat. Hist., vol. xiii, p. 115). Mr. Smith writes: "I have determined the species to which each form of egg-cases belonged simply by comparison of the young shells contained in them with adult specimens of *P. carica* and *canaliculata*; and have ascertained from Mr. Perkins that he made his determination in the same way. I have made a comparison of the young shells contained in the broad-edged cases coming from Fort Macon, with similar ones from Rockaway, L. I., and find them to agree exactly. Mr. Perkins and myself are therefore evidently wrong, the broad-edged cases belonging to *P. carica*, and the sharp-edged to *P. canaliculata*." Egg-cases of the broad form are abundantly strewn on the beach and elsewhere, especially during the summer months; but I do not now call to mind that I ever noticed the sharp-edged ones. 1871.]

Specimens of this species, or of one closely resembling it, vary remarkably in color, and to a notable degree in general contour, number of spines to a whorl, their length and stoutness, &c. Younger individuals, up to three or four inches in length, are much variegated, but pretty regularly so, with the brown bands; the full-grown ones are too different in this respect to be concisely described. The oldest lose distinctive coloration, from the growth of rough dark epidermis, and are usually incrustated with foreign substances, as well as often with balani, ostreae, &c. Inside, the shells appear to have no determinate color; this varying from indefinite whitish, with some variegation from the colors outside showing through (in young specimens), to yellowish or tawny; and finally, in mature spring specimens at any rate, to brilliant salmon—almost red. I should judge that the coloration could afford no reliable specific characters. The shells bleach pure white in time, passing through a tawny or rusty stage; others present slate, or almost black, discoloration. The upper surface of the foot in life is jet black, contrasting strongly with the vivid color of the under side.

This species, and the last, as well as, doubtless, the others, are carnivorous, and apparently rapacious, animals; they also prey upon each other. I have found younger shells of both *carica* and *canaliculata*, enwrapped and half hidden in the folds of large individuals of their own and the other species.

“There are probably several species of *Busycon* on our coast, but they are not well made out. No. 1771, as well as some of the



**Fasciolaria distans**, Lam.

Common. This and young *Busycons* are favorite residences of the larger *Eupagurus*.

**Fasciolaria gigantea**, Kiener.

Two specimens, from the beach, much worn and discolored (slate), each over a foot long.

**Ranella caudata**, Say.

Common.

**Murex spinicostata**, Val.

Not common (two or three specimens).

**Strombus pugilis**, Gm.

Frequent. Of about a score of specimens examined, all were much worn, and had evidently been transported from a distance.

[NOTE.—I append to the foregoing list the names of a few air-breathers that were collected.]

(GASTEROPODA *Pulmonata*.)

**Limax**, sp.

Observed under decaying wood, &c., on Bogue Island.

**Helix albolabris**, Say.

**Helix thyroides**, Say.

**Helix multilineata**, Say.

These three species were obtained, the two first in large numbers, from the beach of Shackleford, but no one of them was seen on Bogue Island.

**Helix postelliana**, Bland.

“Interesting on account of the locality, neither this species nor any other of the group to which it belongs having hitherto been found here” (*Bland*, in epist). Very abundant on Bogue Island, in moist grass, &c., about the edges of the marsh.

**Melampus bidentatus**.

**Melampus obliquus**, Say.

Rather common, on the beach, and dredged in shallow water among marine plants.

## RADIATES.

The few specimens that have been determined, out of a considerable number collected, furnish the following names, mostly 1871.]

given upon Dr. Stimpson's authority: A species of *Physalia*, and another allied form, are of frequent occurrence along the beach. Two or three jelly-fishes were noticed, one of them occurring in large numbers about the harbor. Several corals and sea-fans also occur.

*Ophiophragmam wardemanni?*

Bird Shoals, common.

*Asterias arenicola.*

Abundant.

*Laidia clathrata.*

Very abundant.

*Astropecten articulatus.*

Abundant. Fresh specimens are of a rich purple, edged with golden yellow.

*Melita quinquefora.*

The most abundant echinoderm of all, found everywhere.

*Schizaster lachesis.*

Rather common.

*Echinocidaris punctulatus.*

*Lytechinus variegatus?*

This and the last are two common species, found about the edges of the shoals throughout the harbor.

*Actinia?* sp.

*Amphiprion* sp. (small) common about the beach.

## CONTRIBUTION TO ORTHOPTEROLOGY.

BY PROF. C. THOMAS.

**Caloptenus differentialis.** Thomas.

Syn. *Acridium differentiale*, Uhler. Trans. Ill. St. Ag. Soc., v. 450.  
(Thos.) *Cyrtacanthacris differentialis*. Walk. Cat. Dermap., IV. 610.

Although the name of this insect has found its way into the catalogues, yet it has received no other description than the very short and imperfect one given by me in the Transactions of the Illinois State Agricultural Society, vol. v. 450. It was designated by the name *A. differentiale*, in a box of Orthoptera kindly named and returned to me by Mr. Uhler. But as he has never described it, and, as I learn from him, does not propose to do so, I give here the first regular description, that it may no longer stand in the catalogues as a mere name.

Large, robust; sides of the pronotum squarely deflexed, but lateral carinæ not distinct; wings as long as the abdomen; pulvilli of tarsi remarkably large. General color, olive-brown.

*Female.* Occiput convex, not punctured; a transverse indentation between the angles of the eyes; vertex broad, expanding in front of the eyes, obtuse, with a broad shallow sulcus above (perhaps not always distinct); the frontal carina broad, flat, or very slightly sulcate, sides parallel, a row of slight punctures each side; lateral carinæ obtuse, nearly parallel. Antennæ passing the thorax slightly, slender, filiform, joints not distinct except near the base. Pronotum has the sides squarely deflexed, the dorsum but slightly convex, that of the posterior lobe being almost flat; the three transverse incisions distinct, the posterior, which is deeply indented, being postmedial; the median carina distinct on the posterior lobe, but indistinct on the anterior lobes; the lateral carinæ consist only of the rounded angles formed by the deflexion of the sides. Elytra narrow, about as long as the abdomen. Wings thin and delicate, with slender nerves, a little shorter than the elytra. Abdomen large and fleshy, somewhat keeled above; upper and lower appendages very stout, cerci very short. Posterior femora very much swollen near the base and quite thick, tapering rapidly so as to be rather slender near the knee; a little shorter than the abdomen; not sharply carinated either above or below. Tibiæ much enlarged at the apex; about as long as the femora; the apical half furnished with strong spines and hairy. 1871.]

Claws of the tarsi stout; pulvilli remarkably large. Prosternal spine cylindrical, blunt, and bent back to the margin of the mesosternum.

*Male.* Is only about two-thirds the size of the female, from which it differs as follows: Frontal carinæ more distinct, the middle one more distinctly sulcate. The elytra and wings are longer in proportion to the body, extending beyond the abdomen; the posterior femora also proportionally longer. The abdomen is considerably enlarged at the extremity, and turned abruptly upward; the cerci very large, bent upward and inward, broad at base, with an offset or notch on the lower edge; the little angular processes at the base of the superanal plate are very minute and blunt (much less than in *C. spretus* or *femur-rubrum*); the subanal plate convex, pointed, and almost entire, hairy.

*Color* (dried after long immersion in alcohol).

*Female.* Head and anterior lobes of the pronotum reddish-brown; labrum and parts of the mouth black; antennæ rufous. Posterior lobe of the pronotum an olive-brown. Elytra unspotted, olive-brown at the base, fading toward the extremity. Wings transparent, with a portion of the nerves near the front and apex dark. Abdomen and under side dark reddish-brown. Posterior femora with the disk and upper edge dark brown, lower edge yellowish; inside yellow, with an oblique, interrupted, dark stripe running from the upper edge back across to the lower edge beyond the middle; knee black. Tibiæ have the upper end and lower half yellow, spines black; tarsi brown; claws yellow at base,

*canthacris*, for no other reason, so far as I can see, than that the prosternal spine approaches the border of the mesosternum. Although it differs slightly from the typical species of *Caloptenus*, yet it certainly has more characters of the latter than of the former genus. It is, in shape, very much like the larger specimens of *C. bivittatus*. The back of the pronotum is not sloped from the median carina, but is exactly like the dorsum of *femur-rubrum*, *spretus*, *bivittatus*, etc.

***Opomola brachyptera*, Scudd.**

As Mr. Scudder's description is founded on a single male specimen, I will give a full description of what I conceive to be a female of the same species.

*Female.* Vertex carinated; elytra narrow, reaching the tip of the second abdominal segment. Antennæ broad, ensiform. Pale orange-brown, with minute dusky points.

Occiput convex, straight, not ascending, with a shallow longitudinal depression each side, leaving a low, broad, rounded ridge in the middle. Vertex triangular, margins turned up, a very distinct median carina, the three meeting together in front form a blunt point; length in advance of the eyes equal to about one-third the entire length of the head. The face tricarinate, or rather quadricarinate, as the frontal ridge is so deeply sulcate that it forms two distinct carinæ, which meet at the vertex; all somewhat divergent, and reaching the cross suture. Eyes oblong-ovate. Antennæ scarcely as long as the head and thorax, ensiform, flattened, and slightly prismatic. Pronotum about as long as the head, tricarinate; sides almost perpendicular, parallel; only the posterior transverse impression distinct on the dorsum, situated a little behind the middle. Elytra lanceolate, narrow, reaching the extremity of the second abdominal segment. Wings narrow, minute, about half as long as the elytra. Abdomen long, slender and somewhat cylindrical, slightly carinated on the dorsum. The four anterior legs short and slender; posterior femora slender, straight, and not as long as the abdomen; tibiæ slender, nearly cylindrical, somewhat hairy at the apex. The prosternal point is short, being only a blunt protuberance; behind it the prosternum is marked by a shallow sulcus (but this may not be constant). *Color* (dried after long immersion in alcohol). General color a pale orange-brown, without distinct spots or markings, but with minute dusky points. The antennæ brown, with a purplish tinge; vertex, legs, and abdomen tinged with the same color. Spines of

1871.]

the posterior tibiae, abdominal appendages, and tarsal claws tipped with black.

When living, the only specimen I have seen appeared to be of a uniform grayish-brown. Length 1.5 inches.

My unique specimen was caught near the ruins of Fort Casper, on the North Platte, Wyoming Territory, August, 1870. Found in the tall grass on the river bottom.

*Mesops wyomingensis*, Thos. nov. sp.

Small, slender, cylindrical; elytra reaching the fifth abdominal segment; abdomen of the male terminating in a pointed process. Pale green, sometimes varied with red, immaculate.

*Female*. Occiput convex, slightly bowed up in the middle; a very slight median ridge can be discerned which reaches a little in front of the eyes, where it suddenly terminates in a semicircular depression, which separates it from the vertex. The vertex is flat above, conical, margin not turned up, triangular, advanced considerably in front of the eyes; a shallow foveola may be distinguished under each lateral margin; the circular depression which divides it from the occipital ridge, sweeps round from the upper canthus of one eye to that of the other. The face quadricarinate—the frontal ridge being so deeply sulcate as to appear like two distinct carinae, all prominent, sharp, divergent below, and reaching the cross suture; the sides of the frontal ridge approach each other just below the ocellus, and on each side, directly opposite this constriction, there is a short transverse indentation (this appears to be constant). Eyes oblong-ovate, somewhat promi-

the middle joint being rather longer in proportion to the others than usual. Prosternal point quite short and blunt, more so in the female than in the male. Mesosternum convex, with a sharp indentation running lengthwise on each side.

*Color* (dried after long immersion in alcohol). Pale greenish-yellow, immaculate. Antennæ dull ash color, darkest along the exterior margin. Spines of the posterior tibiæ and tarsal claws tipped with black. When living, the female is of a uniform pea-green color.

*Male.* Differs from the female as follows: Is much smaller and of more slender proportions. The vertex more pointed and the margins slightly elevated. Face rather more oblique, being almost horizontal. Abdomen terminating with a long-pointed extension bent slightly upward at the tip, about equal in length to the head. Elytra and wings same proportional length as in the female. Antennæ, face, vertex, occiput, pronotum, posterior femora, and abdominal appendage a pale carneous red; a white stripe runs from the lower border of the eye along the lower edge of the face and pronotum to the base of the middle legs. This description of the male marks the extreme variation from the female, those of immediate shades being common.

Found along the east base of the Black Hills of Wyoming, in the vicinity of Cottonwood Creek, August, 1870. Taken in the grassy creek bottoms.

*Dimensions.* Female—length 1.1 inch; male, .9 inch.

I have placed this species in *Mesops*, to which it appears to belong from the incomplete generic description of Serville, who had only one imperfect specimen, which had the apex of the abdomen wanting. Walker (Cat. Dermap., III. 501) names another species of this genus—*M. carinatus*—as found in the United States, but speaks of the sheaths of the oviduct of the female as being *lanceolate*.

*Note.*—Two errors occur in my paper published in the Proceedings July, 1870, which should be corrected.

*B. nigrum*, Thos., should be *B. nubilum*, Thos.

SYN. *Gryllus nubilus*, Say.

*Oed. pruinosa*, Thos., should be *Oed. trifasciata*, Thos.

SYN. *Gryllus trifasciatus*, Say.

The descriptions are proper, and may stand, as the original descriptions of Say are very short and incomplete. The corrections were forwarded before publication, but failed to reach their destination.

1871.]

PART II.—11

JUNE 5, 1871.

Mr. VAUX, Vice-President, in the chair.

Nineteen members present.

The publication of pp. 57 to 88 of the proceedings for 1871 was announced.

*Remarks on a Fossil Testudo from Wyoming.*—Prof. LEIDY directed attention to some remains of a fossil turtle discovered by Dr. Joseph K. Corson, U.S.A., of Fort Bridger, at Grizzly Buttes, Wyoming, in association with remains of *Palæosyops*, &c. Most of the remains of turtles from the same locality, which had been submitted to his inspection, appeared to belong to the same family as our terrapins, except those referred to the genus *Trionyx*. The present fossils appear to indicate a large species of land tortoise, equal in size to the living *Testudo indica* of the Galipagos Islands. Less characteristic fragments, apparently of the same turtle, had been previously found by others, especially Prof. Hayden and Dr. J. Van A. Carter. The most characteristic specimen obtained by Dr. Corson is the anterior extremity of a sternum, consisting of the greater part of both episternals and a small portion of the entosternal bone. It might be supposed to belong to an *Emys*, but its abrupt and prolonged extension forward as in several of the living species of land tortoises, coupled with its great thickness and strength, leads to the opinion that it really indicates a large *Testudo*.

The gular scute impressions are defined by strong oblique grooves diverging at angles of about  $40^{\circ}$ . From the outer boundaries of these impressions the episternals are diverged rather

turtle eggs. They were found by Dr. J. Van A. Carter, of Fort Bridger, Wyoming, in the same formation which has yielded so many remains of turtles. Dr. Carter had discovered upwards of forty of them together, and first suggested the idea that they might be eggs. Prof. Hayden's collection from the same vicinity contained several specimens of the same bodies, which had been incidentally glanced at as coprolites. The uniformity in shape and size of these bodies, coupled with the structure, which consists of a thin homogeneous stony shell filled with an arenaceous matrix, renders it probable they may be eggs. They have the elongated oval form of the eggs of our common *Emys picta*, and measure about an inch in length and five lines in the short diameter.

*Remarks on the Garnets of Green's Creek, Delaware Co.*—Prof. LINDY also directed attention to the character of the garnets of Green's Creek, Delaware County. These garnets, usually much prized by our mineralogists, appear not to have been discovered in place, and have been found as part of the pebbles of the creek bottom. They never present a crystalline form, and are looked upon as rolled pebbles. Specimens exhibited show a singular grooved appearance, apparently due to the abstraction of crystals of some other mineral, which had been imbedded in the surface of the garnets. This condition would indicate that the garnets probably existed in the rock in the form of nodules and not of crystals, as is frequently the case with minerals imbedded in trap rocks. In Dana's Mineralogy it is stated that chlorastrolite occurs on the shores of Isle Royale, L. S., in small rounded pebbles which have come from the trap and are water-worn. To avoid an erroneous impression, it should rather state they are found in the trap as rounded nodules, and become detached by the breaking up of the trap on the shores of the lake.

Mr. THOMAS MEEHAN referred to some remarks made by him to the Academy recently in regard to variations in the cotyledons of the peach, in which the most striking fact was that there was a multiplication of cotyledons when there was a plurality of embryos, without any increase in the usual cotyledonous mass; and that in the division of this mass no proportionate rule was adopted in the apportionment of each. He said he could not then understand how this arrangement accorded with the general opinion that the lobes of the dicotyledonous seed were formed almost simultaneously with the origin of the fertilized vesicles, but dared not express his doubts on that one instance alone. But he had now to offer for the examination of the members numerous specimens of sprouting cotyledons of *Quercus robur* and *Quercus rubra*, which seemed to admit of no other conclusion than that the division into cotyledons was accomplished long after the cotyle-

donous mass had been shaped as we find it finally developed in the seed.

In the case of *Quercus robur* a plurality of plantlets from one sprouting seed was not uncommon. He had found dozens in a peck of seed. These were usually in twos, but occasionally in threes. Of the last he exhibited only one specimen. In all these cases there was no more matter employed than if only one dicotyledonous seed had been perfected in the usual way. The division of the mass into four or six cotyledons was very arbitrary. In some cases one cotyledon would have one-third the whole to itself, the remaining being divided between the rest. There was also the same irregularity in direction. In some cases the division, after going longitudinally perhaps one-third the distance, would take a lateral direction, giving a broken-off appearance to the one cotyledon, similar to the leaf of a *Liriodendron*, while the opposite division would thus be left with a thick gibbous tip. The divisions in other cases would take a somewhat spiral course. It was evident that there was little more rule in these divisions than there would be in the breaking of a piece of glass.

He had examined a half peck of sprouting acorns of *Quercus palustris* and another of *Quercus macrocarpa*, but in these he could detect no sign of variation—each seed seemed cleft smoothly and directly through the centre into two regularly equal halves. But in *Quercus rubra* there were some remarkable phenomena. Of these he exhibited numerous specimens. In none of them did he find a plurality of embryos, the interest was in the division of the pair of cotyledons. All the specimens of *Quercus rubra* examined had fissures extending from the outside towards the centre. These were two, three, or four. In some cases the fissures extended but a mere line in depth; at other times they would

tion would prevent the formation of such a membrane, especially after the cells had lost much of their vitality by being converted into depositions of starchy or other matter. Hence we found but the finest membrane covering the cotyledon faces.

He could not understand how the facts exhibited accorded with the early division into cotyledons by actual growth, as taught in our leading botanical works. For himself, he felt that botanists would yet come to regard *all seeds as non-cotyledonous in their early stages; and that the divisions into cotyledonous lobes was a mechanical result* determined in a great measure by the position of the germinal vesicle without the cotyledonous mass.

Mr. Meehan also referred to remarks he made on a former occasion in regard to the sensitive clasping of the stigmatic divisions of the pistil in *Torenia asiatica*. He had since found the same phenomenon in *Mimulus*, *Lindernia*, and *Diplacus*; allies of the *Torenia*. He did not know that this irritable closing power had been placed on record anywhere; but as there were hybrids of *Mimulus* in cultivation, the fact could not but have been noticed by cultivators at some time. In *Mimulus* the motion was more rapid than in others he had tried.

---

JUNE 13.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-seven members present.

The following papers were offered for publication:—

“Notice of a new Brachiopod from the Lead-bearing rocks at Mine La Motte, Mo.” By F. B. Meek.

“Descriptions of three new species of Exotic Unionidæ.” By Isaac Lea.

“Descriptions of twenty new species of Unionidæ of the United States.” By Isaac Lea.

Prof. COPE made some extended observations on the supposed orders of *Plectognathi* and *Lophobranchii* of Cuvier, of which the following is an abstract: He stated that, after an examination of their structure, he could not regard them as divisions of equal value with the *Physostomi* and *Physoclysti*, etc. He stated that the *Plectognathi* are *Physoclysti* in all respects, viz., the relations of the supra-occipital to the other cranial bones, the structure of the scapular arch, hyoid and branchial arches, in the relations of the dorsal and ventral fins, structure of basis of caudal fin, of swim-bladder, etc. The family *Teuthyes*, among other *Physoclysti*, formed the nearest approach to them, and that the coalescence of 1871.]

the bones of the maxillary and mandibular arches is not more important than many other structures found in the same subclass.

He regarded the *Lophobranchii* as a group having the same general affinities with the *Physoclysti*, but aberrant with some other groups in the possession of abdominal ventral fins. It was closely related to another division of the *Physoclysti* which he called the *Hemibranchii*, which has ventral fins, and wants one or more of the outer series of the superior pharyngeal bones, besides other characters. This order embraces the *Fistulariidae*, *Centriscidae*, and *Gasterosteidae*, and should perhaps include the *Lophobranchii* also.

---

JUNE 20.

The President, Dr. RUSCHENBERGER, in the chair.

Sixteen members present.

The following paper was presented for publication:—

"Synopsis of the genus *Chettusia* (*Lobivanellus*), with a description of a new species." By J. A. Ogden.

---

JUNE 27.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-one members present.

The following gentlemen were elected members:—

Fred'k W. Endlich, Edw. K. Williams, and Fred'k Gutekunst.

**DESCRIPTIONS OF NEW SPECIES OF FOSSILS FROM OHIO AND OTHER  
WESTERN STATES AND TERRITORIES.**

BY F. B. MEEK.

The Ohio fossils described in this paper are a part of the collections of the Geological Survey of that State, now being prosecuted under the direction of Dr. J. S. Newberry. Full descriptions and illustrations of these will appear in the reports of this Survey. Those from Illinois will likewise be illustrated and described in the reports of the Survey of that State. For the latter I am under obligations to Mr. William Gurley and Dr. Winslow, of Danville, Illinois.

The *Melantho* and *Viviparus*, described at the end of the paper, belong to collections brought by Dr. Hayden from Wyoming Territory, and were accidentally omitted in my preliminary paper recently published in Dr. Hayden's report. They will be figured along with the others in his final report.

**OHIO COLLECTIONS.**

**FENESTELLA DELICATA, Meek.**

Growing in flat flabelliform, very finely reticulated expansions; branches very slender, rigid, bifurcating, and often nearly parallel, or gradually diverging to give room for new ones formed by division; dissepiments about half as thick as the branches, alternating or opposite, and but little expanded at their ends as seen on the non-poriferous side; fenestrules very uniform, oblong, with length usually about one-third to one-half greater than their breadth; non-poriferous side roughened by little granules; poriferous side with a row of little pointed elevations along a more or less defined mesial ridge of each branch, pores comparatively large, alternating and numbering two, or occasionally three, in each row opposite each fenestrule, and one generally exactly at each end of each dissepiment.

Size of entire polyzoum unknown, but it apparently attains a length of three inches or more; number of fenestrules in 0.20 inch, measuring longitudinally, three; ditto, measuring transversely, four.

371.]

As seen on the non-poriferous side, this species closely resembles Prof. McCoy's figure of his *F. plebeja*, as represented natural size, excepting that it forms a slightly finer network. Under a magnifier, however, it is seen to differ in having a row of little nodes along each branch, and I have not seen any longitudinal striæ on its branches, though they probably exist on those of perfect specimens. The magnified figure of the poriferous side of *F. plebeja* shows still more important differences, its fenestrules being proportionally much longer, with four or five pores opposite each side. The little nodes or projections along the middle ridge of this side of the branches in our species do not exist in *F. plebeja*, nor does the latter usually have a pore opposite the end of each dissepiment, as in the species under consideration.

*Locality and position.* Lodi, Ohio. Waverley group of Lower Carboniferous.

**PTILODICTYA (STICTOPORA) CARBONARIA, Meek.**

Ramose, branches from their origin generally nearly equalling the breadth of the stem from which they spring more or less alternately and at angles of about  $50^{\circ}$  to  $60^{\circ}$ ; poriferous surfaces of each side flattened convex; lateral margins sharp and smooth; pores arranged in quincunx so as to form about seven to nine longitudinal rows (those of each two adjacent rows alternating), and about the same number of pores may be counted in each oblique row, very nearly or quite circular, and each with a promi-

two widely-separated horizons would doubtless show other differences of details.

Its branches are narrower, and the number of its longitudinal rows is less than in the species from the Corniferous limestone that I have described under the name *P. Gilberti*, which also differs in having longitudinal ridges between the rows of pores.

*Locality and position.* Newark, Ohio. Coal-measures (lower part).

**AVICULOPECTEN SANDUSKYENSIS, Meek.**

Shell attaining a rather large size, strongly compressed, very nearly equivalve, rather oblique, somewhat longer in its antero-posterior diameter than high; posterior margin rounded and somewhat produced below, and sloping upward and forward above; anterior margin rounding obliquely backward and downward from the anterior ear into the base, which is semiovate, being a little more prominent behind than anteriorly; hinge line rather distinctly shorter than the entire antero-posterior diameter of the valves; ears flat, subequal, and acutely pointed, the posterior one being shorter than the margin below, and the anterior sometimes longer than the anterior margin beneath; in the left valve both are defined by somewhat angular nearly equal marginal sinuses, while in the right valve the anterior one is slightly concave and defined by a more angular sinus, from which a linear impression extends obliquely upward to the beak, which seems not to project above the cardinal margin; beak of left valve slightly more convex than that of the other, but scarcely more prominent, and placed a little in advance of the middle of the hinge. Surface of left valve ornamented by numerous unequal, slender, radiating costæ or thread-like lines, that are narrower than the spaces between, and obscure concentric striæ, only the latter of which are usually seen on the ears; surface of right valve similarly but less distinctly marked.

Antero-posterior diameter of a specimen under medium size, 1.27 inches; height, measuring at right angles to the hinge, 1.20 inches; convexity, about 0.16 inch. Some specimens were, when entire, evidently not less than twice the linear dimensions of that from which these measurements were taken.

As near as can be determined from Mr. Conrad's rather brief

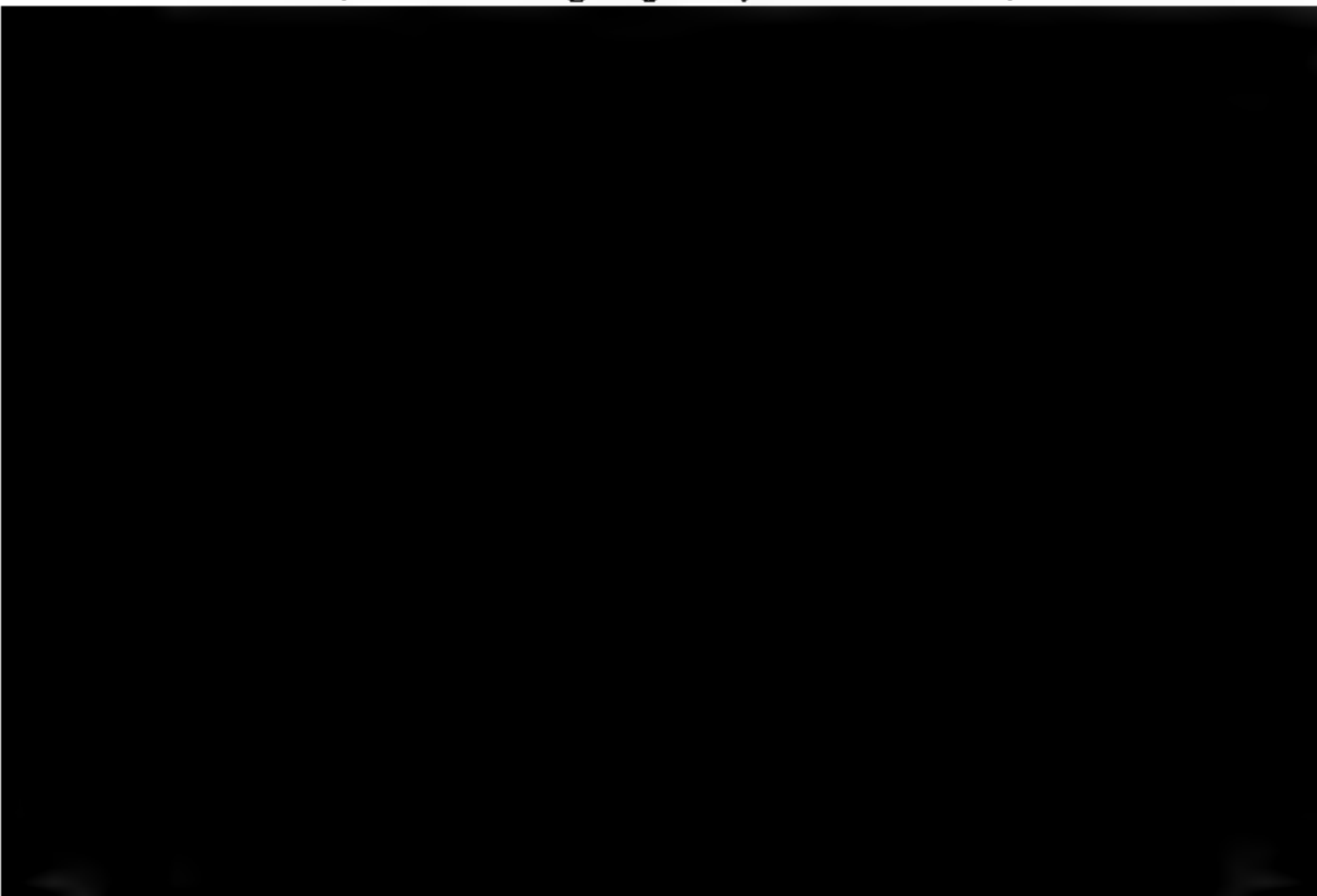
description, and his figure of a single right valve of his *Avicula parilis* (Journ. Acad. Nat. Sci. Philad., vol. 8, pl. xii., fig. 9), the species under consideration would seem to be somewhat nearly allied. It has nearly the same general outline and obliquity, and somewhat similar ears, though its anterior ear is proportionally shorter, and defined by an impressed line extending from the sinus obliquely upward to the beak. Our shell also differs in being very nearly or quite equivalve, instead of having the right valve flat and the left plano-convex.

I know nothing of the hinge of this shell, and therefore merely refer it provisionally to *Aviculopecten*. It is rather more oblique than the species of that genus generally are, and possibly it may be found to have the internal characters of *Pterinea* or *Avicula*, and thus have to take the name *Pterinea Sanduskyensis* or *Avicula Sanduskyensis*.

*Locality and position.* Sandusky and Delaware, Ohio. Corniferous group of the Devonian series.

**PTERINEA (PTERONITES?) NEWARKENSIS, Meek.**

Shell small, longitudinally subovate or truncato-semiovate, about two-thirds as wide (high) as long, being wide behind and narrowing anteriorly; cardinal margin straight or slightly curved in outline behind the beaks, and about two-thirds the length of the valves, very short and declining in front of the beaks; posterior margin truncated so as to intersect the hinge at an angle of about  $100^{\circ}$ , but rounding regularly into the base; anterior side



anterior extremity. (Right valve unknown.) Length of left valve .55 inch; height (behind the middle), 0.35; convexity, 0.10 inch.

This is one of those peculiar forms presenting an intermediate appearance between *Avicula*, *Pterinea*, and *Pteronites*, but not agreeing exactly in outline with well-defined species of any of these groups. So far as can be determined from casts of the left valve only, it does not appear to have had the hinge teeth of *Avicula* or *Pterinea*; while it also differs from the latter in not having the posterior extremity of the hinge extended or acutely angular, though there is an obtusely angular, slight posterior dorsal alation, which, however, is not defined by any sinuosity of the posterior margin. From the forms on which the genus *Pteronites* was founded, it differs in having the hinge a little shorter than the posterior margin, and its beaks further removed from the anterior extremity.

There are probably several undefined genera among the Carboniferous shells of this general appearance, that we have not yet the means of defining.

*Locality and position.* Newark, Ohio. Waverley group of the Lower Carboniferous series.

#### CYPRICARDINA? CARBONARIA, Meek.

Shell small, longitudinally oval, less than twice as long as high, the widest (highest) part being under the posterior extremity of the hinge; rather gibbous, with often a shallow undefined impression or slight concavity extending from the beaks obliquely backward and downward to near the middle of the basal margin; posterior side rounded below the middle, and somewhat straightened and sloping up obliquely forward to the posterior extremity of the hinge; anterior side extremely short and more or less rounded; cardinal margin nearly straight or slightly arched, and about two-thirds the length of the valves, sometimes showing a very faint compression, or tendency to become a little alate behind; base most prominent posteriorly, and gently ascending forward, with a more or less defined broad sinuosity along the middle; beaks extremely oblique, terminal, and so little prominent as scarcely to project beyond the rounded outline of the anterior end. Surface ornamented by about twenty, very regularly disposed, subimbricating laminae of growth.

Length, 0.56 inch; height, 0.34 inch; convexity, about 0.17 inch.

This little shell agrees very nearly, in size, form, and ornamentation, with the typical forms of the group for which the name *Cypricardina* was proposed, excepting perhaps the fine sculpturing seen between the larger regularly disposed lamina of growth in those shells, though even these markings may possibly exist on well-preserved specimens of our species.

In regard to the hinge of the typical species of *Cypricardina*, nothing is known. In the shell here described, however, one of the casts shows a moderately well developed hinge plate, with one linear tooth in one valve, and two in the other, running nearly parallel with the cardinal margin along its entire length, and at the posterior end of the hinge one or two shorter linear teeth parallel to and beneath the others; while at the anterior end of the hinge, in the right valve, there is one very small, slightly oval tooth, fitting between two similar minute teeth in the left valve. These little teeth are slightly compressed from above and below, and range with their longer diameter nearly parallel to the hinge margin. No cardinal area can be seen, though there may have been a very small narrow one immediately between the beaks, as there is no cavity seen in the hinge margin for an internal cartilage. The muscular and pallial impressions are so faintly marked that no traces of them have been seen on the casts of the interior.

Until the hinge of the typical species of *Cypricardina* can be



If *Cypricardina* should be found to have a differently constructed hinge, I would propose for the group of which the species here described might be regarded as the type, the name *Synopleura*, in allusion to its very regular concentric costæ or annulæ of growth. It is still possible, however, that this group may be found too nearly allied to *Cypricardites* to stand as a distinct full genus; if so, the name of the species under consideration would have to be written *Cypricardites (Synopleura) carbonaria*.

*Locality and position.* Newark, Ohio. Lower Coal-measures.

**SCHIZODUS MEDINAENSIS, Mook.**

Shell of medium size, subtrigonal, moderately convex above the middle and cuneate below, somewhat longer than high; anterior side rounded; basal margin somewhat straightened or slightly convex in outline along the middle, rounded up regularly in front and more abruptly behind; dorsal outline sloping nearly at right angles from the beaks toward the extremities, the anterior slope being more abrupt than the other; posterior side longer than the anterior, sloping with a more or less convex or subtruncate outline above, and very narrowly rounded below; beaks rather prominent, pointed, located a little in advance of the middle; posterior umbonal slopes rather prominently rounded or subangular from the beaks obliquely to the posterior basal extremity. Surface nearly smooth, or only showing fine lines of growth.

Length, 1 inch; height, 0.82 inch; convexity, 0.44 inch.

This species has been supposed to be identical with, or nearly related to, a New York Chemung form, which was, I believe, described by Mr. Conrad under the name *Nuculites Chemungensis*. It certainly differs, however, materially in form from that shell as figured and described by Mr. Conrad in vol. viii. of the Journ. Acad. Nat. Sci. Philad., and might with as much propriety be identified with western Coal-measure species, ranging even up into beds referred by some to the Permian. One of these, described by Prof. Swallow under the name *Cypricardia? Wheeleri* (Trans. St. Louis Acad. Sci., vol. ii. p. 96, 1862), and figured by Prof. Geinitz under the name *Schizodus obscurus*, in his "Carbonformation und Dyas in Nebraska," agrees more nearly in form, but differs in being decidedly more depressed, with less elevated beaks, and a more

1871.]


truncated posterior outline. It also differs from the shell under consideration, in being sometimes a little sinuous on the posterior basal margin. Another Coal-measure form figured by Prof. Geinitz, under the name *Schizodus Rossicus*, is in some respects still more nearly like our shell, but differs in other characters.

As difficult as it certainly sometimes is to separate closely allied species of this genus, I cannot think that we ought to refer to the same species forms found occupying such widely different horizons as the Chemung group of the Devonian, and the Waverley group and Coal-measure of the Carboniferous; on the contrary, it seems to me that we ought to regard them as distinct species, although it may not be easy, in all cases, to point out well-defined distinctions in the fossilized shells.

*Locality and position.* Medina, Ohio. Waverley group of the Lower Carboniferous.

**SCHIZODUS SUBTRIGONALIS, Meek.**

Shell trigonal-subovate, about once and a half as long as high, rather convex; basal margin more or less nearly semicircular in outline, rounding up regularly in front and abruptly behind; anterior side short, rounded or subtruncate; posterior side somewhat extended, rounded below, and slanting very obliquely forward and upward above to the posterior extremity of the hinge, which is short and a little straightened; posterior umbonal slopes prominently rounded; beaks somewhat depressed and usually nearer the anterior end than the middle. Surface smooth, with



**ALLORISMA WINCHELLI, Meek.**

Shell of about medium size, elongate subelliptic, the length equal to about three and a half times the height, moderately convex; posterior extremity a little gaping, obliquely subtruncated above and narrowly rounded below the middle; anterior extremity extremely short, closed, concave in outline obliquely forward and downward from the beaks above, to the lower end of the lunule, where it is subangular, and from this point rounding off obliquely into the base; ventral margin forming a broad, gentle curve, but generally somewhat straightened, and sometimes faintly sinuous near the middle; dorsal margin nearly straight, or a little concave in outline, and showing the usual inflection, which forms a lanceolate escutcheon with a slight ridge on each side, from the beaks to the posterior extremity of the hinge, which equals about three-fourths the entire length of the valves; beaks much depressed, very oblique, incurved, and located only about one-fourteenth the entire length of the shell from the anterior extremity; posterior umbonal slopes merely somewhat prominently rounded; anterior umbonal slopes generally subangular near the beaks, and sometimes this prominence is obscurely continued as a faint rounded ridge obliquely backward and downward to a point a little in advance of the middle of the base. Surface ornamented with concentric lines and ridges of growth, that generally assume the character of little regular wrinkles on the umbones. Lunule small, rather deep, moderately well defined, and obovate in form.

Length of a mature specimen, 1.74 inches; height to middle of dorsal side, 0.83 inch; do. to horizon of beaks, 0.87 inch; convexity, 0.70 inch; length of hinge line, 1.17 inches.

This is a very neat, symmetrical species, often found in an excellent state of preservation as casts of the exterior showing perfectly the form and surface-markings, excepting the fine granulations usually, if not always, existing in species of this genus. Like other species of the group, it varies more or less in form, some individuals being proportionally shorter and higher than others. In size and general appearance it closely resembles *A. clavata* of McChesney, from the Chester group. It does not resemble the particular *variety* of that shell, however, figured by Prof. McChesney, so nearly as it does what I have always believed 1871.]

to be the usual form of the same, his typical specimen having the beaks more prominent and farther removed from the anterior end than in the more normal form of the species, and its dorsal outline straighter and more sloping posteriorly, with the valves more compressed. Compared with specimens that I have referred to, *A. clavata* from the Chester group of West Virginia, collected by Prof. Stevenson, our Waverley species are found to agree very nearly with some individuals of the latter, though it always has its ridges of growth less strongly defined and more irregular, and its anterior basal margin usually more oblique. It also differs in the possession of an anterior umbonal ridge extending from the beaks obliquely backward and downward nearly or quite to the basal margin a little in advance of the middle.

The specific name is given in honor of Prof. A. Winchell, the able State geologist of Michigan, who has described many fossils from the same horizon in the western States.

*Locality and position.* Rushville and Newark, Ohio. Upper part of the Waverley group of the Lower Carboniferous.

**ALLORISMA VENTRIOSA, Meek.**

Shell subovate, the length being about once and a half the height, moderately convex; posterior margin obliquely subtruncated above, and narrowly rounded or subangular near the middle, thence sloping obliquely under and forward; base rather deeply and somewhat irregularly rounded, the most prominent part being near the middle; anterior side short, with an oblique truncate or

age, 1 inch. Another specimen, 1.54 inches in length, has a convexity of 0.75 inch.

It is barely possible that this may be a variety of the last, but as I have before me ten good specimens of that shell, and two of the form under consideration, and there are among them no intermediate gradations between the two forms, I can but regard them as distinct species. The shell here described differs from the last, with which it was found associated, in being proportionally decidedly shorter and wider (higher), as well as in having its ventral margin much more prominent or deeply rounded in the central region. Its beaks are also less oblique, rather more prominent, and proportionally farther from the anterior end. It shows some faint traces of a similar anterior oblique umbonal ridge to that seen in the preceding species, but it is less distinct, and does not show so decided a tendency to become angular at the beaks.

*Locality and position.* Rushville, Ohio. Waverley group.

**PLATYOSTOMA? TRIGONOSTOMA, Meek.**

Shell strongly depressed or subdiscoid, with the periphery angular; spire so low that the shell is less convex above than below the periphery; volutions three, very rapidly increasing in size, particularly in breadth, merely with an outward slope above; last one large and compressed convex, but not much projecting below, a little declining near the aperture on the inner side above; suture linear; aperture large, subtrigonal, with breadth greater than height; lip extended forward on the inner side above, and apparently very oblique. (Surface marking unknown.)

Breadth 1.35 inches; height about 0.60 inch.

I am not sure that this is a true *Platyostoma*. It is far more depressed in form than any of the described species of that genus, and, judging from some faint undulations on the cast apparently corresponding to the direction of the lines of growth on the upper and lower sides of the body volution, these lines would seem to have curved strongly backward in passing outward toward the periphery, thus indicating the presence of a rather deep, broad sinuosity of the lip at the termination of the peripheral angle. If this is the real direction of the lines of growth, it would probably be nearer correct to call the species *Pleurotomaria trigonostoma*; but as there is no appearance of a band on the periphery, and the lines of growth are not *certainly* known to describe these curves, 1871.]

I have concluded to place it provisionally in the genus *Platystoma*.

I should perhaps remark here, that this is certainly not a depressed variety of *Platystoma Niagarensis*; and the specimens clearly show that they have not been accidentally compressed. In internal casts there is a small umbilical perforation, but this was probably occupied by the columella, before the shell itself was dissolved away.

*Locality and position.* Yellow Springs, Ohio. Niagara group of Upper Silurian.

**PLATYCERAS (ORTHOONYCHIA?) LODIENSE, Meek.**

Shell rather small, non-spiral, or merely having the form of rapidly expanding cone, with a backward obliquity that brings the apex nearly over the posterior margin; lateral slopes nearly straight or slightly concave, and converging to the apex at an angle of about  $80^{\circ}$ ; posterior side vertical and a little concave in outline; anterior slope somewhat more than twice as long as the height of the posterior side, moderately convex in outline, and provided with a ridge or obtuse carina along its entire length; aperture oval suborbicular, being slightly longer than wide; lip a little sinuous anteriorly, immediately on one or both sides of the termination of the central ridge of the anterior slope, which ridge is thus made to terminate in a little projection of the margin. Surface marked by fine lines of growth, most distinct on the an-

volume of the Palæontology of New York, from the Oriskany Sandstone, under the name *Cyrtolites expansus*, excepting that its apex is not so alternate. Although possibly not a true *Platyceras*, it seems to be more nearly allied to the section of the same for which the name *Orthonychia* has been proposed than to *Cyrtolites*, which was founded on a very different type (*C. ornatus*, Con.), with a very peculiar style of ornamentation. In its surface markings our shell agrees with *Platyceras*, in being merely marked with fine lines of growth more or less undulated on the anterior slope, with traces of very obscure radiating striæ, which latter, with its non-spiral form, indicate relations to the section *Orthonychia*. It therefore bears the same relations to the elongated forms of *Orthonychia* that the depressed, rapidly expanded species of *Platyceras*, such as *P. obscurum*, bear to the typical forms of the genus.

*Locality and position.* Lodi, Ohio. Waverley group of the Lower Carboniferous series.

#### PLATYCERAS TORTUM, Meek.

Shell very thin, dextral, attaining a medium size; in young specimens composed of about one and a half to two volutions subglobose, these first turns being contiguous, rounded and rapidly increasing in size, after which the next turn, which composes the larger part of the shell, becomes free, very oblique, and increases little in size toward the aperture, thus making the entire form very obliquely subrhombic; body volution a little flattened on the upper slope, subangular above, and somewhat prominently rounded near and below the middle; aperture apparently oval suborbicular; lip without sinus; surface without plications, and with only moderately distinct lines of growth.

Length, 1.36 inches; breadth, 1 inch; breadth of aperture, 0.80 inch; height of aperture, 0.82 inch.

I have long been familiar with casts of this shell in the collections of the Illinois Survey, but as they were only casts of the interior, I had some doubts whether they might not be from distorted specimens of some of the other *Gasteropoda* already described. The specimens from which the above description was made out, however, retain the shell itself, and show that it is a true *Platyceras*. Specifically it is more nearly allied to some of 1871.]

the non-plicated varieties of the N. York Upper Silurian *P. spirale*, than it is to any of the other Carboniferous species known to me, though its first two volutions are more compactly coiled together than those of that species.

*Locality and position.* Greentown, Summit Co., Ohio. Coal-measures.

**HOLOPEA (CYCLORA) NANA, Meek.**

Shell very small, subglobose, wider than high; spire much depressed; volutions three, rounded, increasing rapidly in size, so that the last one forms the larger part of the shell; suture deep or almost channelled; surface smooth; umbilicus small; aperture subcircular; lip simple.

Height of the largest specimen seen, 0.05 inch; breadth, 0.07 inch.

This little shell seems to be quite abundant, and from the fact that the larger specimens present considerable uniformity of size and general appearance, I can scarcely doubt that they are adults. It will probably fall into the genus *Cyclora*, Hall (Am. Jour. Sci. and Arts, vol. xlviii. p. 294, 1845), and would seem to agree closely in size and form, as near as can be determined from a description alone, with the typical species *C. minuta*. So far as I have been able to determine, its inner lip, however, does not appear to be reflected over the minute umbilicus, as is said to be the case in that shell. The *C. minuta* came from the Cincinnati group at Cincinnati, and it is very improbable that it ranges up to the

striæ gradually increase in size, and become more irregular in their arrangement, but soon pass above into very regular larger transverse lines, separated by spaces about twice as wide as the lines themselves. These spaces gradually increase in breadth, until they become five or six times as wide as the lines, above which point they continue very regular in their arrangement, about four of the lines and three of the intervening spaces occupying a space of 0.10 inch. Near the smaller end, the flattened spaces show what appear to be impressions of septa made visible through the thin shell by pressure. Two of these occupy a space of 0.10 inch.

As it is seen flattened in the matrix, the very regular transverse lines on this fossil give it somewhat the appearance of an attenuated *Conularia*; but as it shows no indications whatever of longitudinal angles or furrows, it cannot belong to that genus, from which it also differs in texture, though I am not quite sure that it is an *Orthoceras*. It will be readily distinguished by its surface-markings alone, from any species of the latter genus hitherto described from our Coal-measures. In its surface-markings, it bears some resemblance to *Dentalium cinctum*, de Koninck (Am. Foss. Belg., pl. xxii., Fig. 3), which Prof. de Koninck afterwards refers to the genus *Orthoceras*. Our shell, however, is much more rapidly tapering, and straight instead of arched.

*Locality and position.* Newark, Ohio. Lower Coal-measures.

## ILLINOIS COLLECTIONS.

### 'STREPTACIS WHITFIELDI, Meek.

Shell small, elongated, slender, and very gradually tapering; volutions nine or ten, increasing gradually and regularly in size; first or embryonic turn minute, planorbicular and standing edge upward; succeeding turns convex and obliquely coiled; suture deep and very oblique; aperture ovate. Surface smooth.

Length, 0.16 inch; breadth, 0.04 inch; slopes of spire straight, with a divergence of about thirteen degrees.

This little shell agrees so nearly with those Tertiary species on which Deshayes founded his genus *Aciculina*, that I am strongly

<sup>1</sup> I referred this shell to *Aciculina*, Desh., in MS.; but as that name was preoccupied, I propose for our type the name *Streptacis*.

[1871.

inclined to think it belongs to that group. It has exactly the form, size, surface, aperture, and lip, and even the irregularity, of the embryonic volutions seen in *Aciculina*; while the only difference I have been able to see is, that its embryonic turns, instead of forming a minute cone turned to one side at right angles to the longitudinal axis of the body of the shell, have the form of a *Planorbis* standing edge upward. Whether or not this slight peculiarity in the minute apex may have been accompanied by some important difference in the structure of the animal, it is of course impossible to say.

The specific name is given in honor of R. P. Whitfield, Esq., of Albany, New York.

*Locality and position.* Danville, Illinois, where it occurs with many other small shells of the Coal-measures, in a bed of shale immediately over the coal-mine of that place.

**LOXONEMA ATTENUATA, var. SEMICOSTATA.**

*Chemnitzia attenuata*, Stevens, 1858, Am. Journ. Sci., vol. xxv. (Sec. series), p. 259.—(Not *Loxonema attenuata*, Hall, 1859.)

Shell very small, elongate-conical, somewhat more tapering above than below the middle; volutions about twelve, slightly convex and increasing gradually in size from the apex, the last one being rounded and not larger in proportion to the regular increase of the whole than the others; suture distinct; aperture ovate, scarcely equalling one-fourth the entire length of the shell. Surface of the upper volutions (excepting one or two of the smooth

One of the specimens of this species shows some indications of having the immediate apical turn, as it were, very slightly uncoiled, from which I am inclined to suspect that its embryonic volution may have been reversed. This and the very small size of the species seem to separate it from the typical *Loxonemas* and approximate it to *Turbonilla*. If its apex really was reversed, it should be placed in the latter genus, with the name written *Turbonilla attenuata* var. *semicostata*.

*Locality and position.* Shale over the coal-bed at Danville, Illinois.

#### MURCHISONIA OBSOLETE, Meek.

Shell small, conical; spire moderately prominent, with lateral slopes, straight, or sometimes very slightly concave a little above the middle, rather attenuated near the apex; volutions about ten, compactly coiled, and regularly and gradually increasing in size from the apex, compressed convex; last one not enlarged, or more produced below than in proportion to the general increase in the size of the others, somewhat prominently rounded, but not even subangular below the middle; aperture subrhombic, being a little longer than wide, angular above, apparently angular or effuse on the inner side below, and rather abruptly rounded on the outer side below the middle, while the arcuate character of the columella gives a rounded appearance to the middle of the inner side; suture deeply impressed; spiral band very obscure, being flat, even with the surface, and only defined by the faintest possible impressed line along its upper and lower margins. Surface almost entirely smooth, but showing, when closely examined, very obscure traces of marks of growth curving strongly backward as they approach the spiral band, which passes around rather less than its own breadth above the suture on the volutions of the spire.

Length of largest specimen, 0.95 inch; breadth, 0.37 inch.

This species will be at once distinguished from the last, by its shorter and more compactly coiled volutions, and almost entirely smooth surface, on which no traces of revolving lines, or of the distinct regular lines seen on that shell, occur. It also wants the impressed line immediately below the suture of *M. loxonemoides*. It is very peculiar in having the revolving band almost entirely obsolete.

*Locality and position*, same as last.

**PLEUROTOMARIA TEXTILIGERA, Meek.**

Shell attaining a medium or somewhat larger size, turbinate or rhombic, suboval in general outline, with height a little greater than the breadth; spire depressed conical; volutions four or five, flattened exactly on a line with the slope of the spire from the apex to near the middle of the last turn, where there is more or less defined angle; last turn large, somewhat ventricose below the angle, and produced so as to make this angle near the middle of the entire bulk of the shell; umbilical region a little excavated, the excavation apparently being continued as a small perforation up into the axis; aperture, as inferred from sections of the body volution, obliquely rhombic-oval; suture merely linear, or sometimes very narrowly channelled between the middle volutions; spiral band occupying, and slightly truncating, the angle of the body volution, where it is flat or a little concave, and passing around immediately above the suture on the volutions of the sphere, excepting on some of the upper turns, where it seems to sink nearly or quite below the suture line. Surface very neatly cancellated by distinct, regular, curved, threadlike transverse and revolving lines, of about equal size and distance apart, the former becoming much finer and arched backward in crossing the band.

Height of a large specimen, 1.42 inches; breadth of revolving band on body volution, 0.10 inch; angle of spire,  $70^{\circ}$  to  $80^{\circ}$ .

I was for some time inclined to think this might be the form described by Dr. White and Mr. Whitfield, from the same horizon

*Locality and position.* Medina, Ohio. Waverley group of the Carboniferous, where it seems to be quite abundant.

**PLEUROTOMARIA GURLEYI, Meek.**

Shell small, with breadth somewhat greater than its height; spire depressed-conical, slightly obtuse at the immediate apex; volutions five and a half, convex, and near the apex rounded, but becoming nearly rectangular farther down, the angle being at the middle of those of the spire, and passing around above the middle of the body whorl, which is rather convex but not much produced below; upper side of all the volutions (excepting the rounded ones near the apex) sloping a little and flattened or slightly concave from a linear revolving carina just below the suture, outward to the mesial angle, below which the outer side is vertically flattened and smooth; suture canaliculate; revolving band very narrow, rather distinctly concave, with a linear ridge or minute carina along each margin passing around upon or just above the mesial angle; umbilicus very small. Surface on the inner side of the body volution ornamented by about fourteen distinct raised revolving lines, the upper of which are somewhat larger than the others, and on the upper slope above the mesial angle, by three or four very small revolving lines; while the small rounded whorls near the apex are each occupied by about six revolving lines; striæ of growth very minute, and, on the upper slope and flattened outer side of the whorls, very strongly and abruptly curved backward to the band, so as to indicate an unusually profound, rapidly widening sinus in the lip. Aperture wider than high, and obliquely subrhombic in form.

Height, 0.17 inch; breadth, 0.20 inch; slopes of spire straight; divergence of same nearly rectangular.

This little shell has much the form and general appearance of *P. Grayvillensis*, N. & P., but may be distinguished at a glance by the differences in the details of its sculpturing; and particularly by the smooth vertically flattened outer side of its volutions, in which the lines of growth are seen, by the aid of a magnifier, to be much more obliquely curved backward than those on the corresponding part of *P. Grayvillensis*. It must be very rare, as I have seen only the single typical specimen among all of the Coal-measure fossils of the western States and Territories that have ever come under my observation.

[1871.]


The typical specimen is beautifully mineralized by brilliant iron pyrites, and was discovered by Mr. William Gurley, of Danville, Illinois, in honor of whom I have named the species.

*Locality and position.* From the shale over the Danville coal-bed, Danville, Illinois.

## COLLECTIONS FROM MISSOURI, WYOMING, TEXAS, &c.

### AVICULOPECTEN? WILLIAMSII, Meek.

Shell small, subcircular, convex lenticular not oblique; hinge shorter than the antero-posterior diameter of the valves; anterior and posterior margins rounding regularly into the rounded base; beaks a little nearer the posterior than the anterior extremity of the hinge. Right valve rather distinctly convex, the greatest convexity being in the middle; anterior ear of moderate size, shorter than the anterior margin, rather acutely rounded at the extremity, compressed so as to be distinctly separated from the swell of the umbo, and defined from the margin below, by a moderately deep angular sinus; posterior ear a little smaller than the anterior, and, although compressed, less distinctly defined from the convexity of the umbonal region, considerably shorter than the posterior margin, and nearly rectangular at its extremity, but with its posterior margin slightly sinuous. Left valve a little more convex than the right, but otherwise similar, unless there is some difference in the ears, which are not known. Surface of



Specifically, it seems to be more nearly allied to *Aviculopecten neglectus* (= *Pecten neglectus*, Geinitz) from the Coal-measures, than to any other form known to me. It has much the same form, and agrees in having the body part of both valves smooth, and the ears costated, or at any rate the anterior one of the right valve. It has a rather shorter hinge, however, more convex valves, and a rather more rounded general outline, with less deeply sinuous margins under the ears; while it attains a somewhat larger size. It may be regarded as the Lower Carboniferous representative of that Coal-measure species, as many of the other forms from this horizon represent species in the Coal-measures.

The specific name is given in honor of Dr. G. A. Williams, of Boonville, Missouri, to whom I am indebted for the typical specimens.

*Locality and position.* Chonteau Springs, Boon County, Missouri; from the beds called the Chonteau Limestone in the Geological Reports of that State, but now known to belong to the same horizon as the upper part of the Waverley group of Ohio.

**SPIRIFER (TRIGONOTRETA?) TEXANUS, Meek.**

Shell scarcely attaining a medium size, very gibbous in the adult, varying from subquadrate or subglobose to longitudinally subovate, the widest part being generally in advance of the middle, and the length greater than the breadth; hinge line short, or in young individuals scarcely equalling the breadth of the valves, and in the adult often proportionally very decidedly shorter, sometimes obtusely angular at the extremities, while in the more gibbous individuals its extremities do not project beyond the lateral slopes; anterior margin often somewhat emarginate in the middle. Dorsal valve truncato-subcircular or subquadrate and moderately convex; beak incurved with the narrow area, but not prominent; mesial elevation commencing as a small simple plication at the beak, but rapidly widening and becoming more prominent and angular, with, on each side, several small costæ, which divide so as to form altogether 14 to 16 at the front; lateral slopes having at the beak each two or three plications or costæ, which farther forward divide so as to form as many fascicles, beyond which the costæ become uniform, smaller, and number about 9 on each side

of the mesial fold and sinus. Ventral valve more gibbous than the other, and strongly arched from beak to front; beak very prominent in the adult, always point and distinctly curved backward over the hinge; cardinal area moderate, well defined, extending to the extremities of the hinge, directed backward and strongly curved with the beak; foramen slightly wider at the hinge than its height, open nearly or quite to the apex, and provided with a distinct marginal furrow on each side; mesial sinus angular, commencing small at the beak, but widening and deepening very rapidly to the front, where it is very profound, and terminates in a strongly curved triangular projection that fits into a corresponding sinus in the margin of the other valve; surface costated as in the other valve, the costæ in the sinus being smaller than those on the lateral slopes; fine, rather obscure undulating striæ, and near the front and lateral margins a few stronger marks of growth traverse the valves parallel to the free margins; while numerous small, rather scattering but regularly disposed granules, apparently the remaining bases of minute spines, may be seen on the whole surface of well-preserved specimens; which also sometimes show traces of extremely minute radiating striæ.

Length of a large gibbous example, 1 inch; breadth, 0.88 inch; convexity, 0.82 inch; length of hinge, 0.57 inch. Smaller specimens are proportionally shorter, wider, and less convex, with a longer hinge line.

Small specimens of this species resemble somewhat the more gibbous forms of *S. cameratus*, with a very short hinge line; but



Compared with foreign forms, this shell seems to be most nearly like the extremely narrow and elongated variety of *S. duplicosta*, Phillips, as illustrated by Mr. Davidson's figure, 8, pl. iv., Mongr. British Carb. *Brachiopoda*. It is much more gibbous, however, with a decidedly more prominent and more angular mesial sinus, while its surface granules and minute striæ serve to distinguish it. Although its mesial fold has a very angular appearance, a careful examination shows it to be very slightly flattened, or even faintly furrowed along its prominent middle; while there is sometimes a faint indication of a slightly more prominent rib in the middle of the angular sinus of the other valve.

*Locality and position.* Young County, Texas; where it was found by Mr. H. R. Roessler associated with Coal-measure fossils.

I have never seen it from any of the western localities north of Texas.

**CAMPELOMA (MELANTHO) MACROSPIRA, Meek.**

Shell attaining a large size, thick and strong, elongate-subovate; spire much elevated; volutions five, convex but not rounded, increasing gradually in size, excepting the last one, which is more abruptly enlarged, oblique, and somewhat produced below; suture strongly defined; aperture ovate, nearly or quite half the length of the shell; inner lip thick and more or less reflected in the adult, but leaving uncovered a rather distinct umbilical impression. Surface with only moderately distinct marks of growth.

Length of an adult, 1.70 inches; breadth, 1.10 inches.

Specimens of this species have been brought by various exploring parties, during the last eight or ten years, from the Bear River country, Utah; but always in too imperfect a condition to show their characters clearly, until some recently brought in. These show it to resemble, when not distorted, an abnormally elongated specimen of *C. (Melantho) integra*, Say, figured by Mr. Binney in his Smithsonian monograph, part iii., p. 49, excepting that its volutions are less convex, its spire a little narrower below, and its body volution and suture more oblique. Its inner lip is also less oppressed to the columella, so as to leave a decided larger and deeper umbilical impression. It is likewise a thicker, stronger shell than any of the varieties of *C. decisa* I have ever seen, being as thick as *C. ponderosa*, if not thicker.

I have sometimes been inclined to think Prof. Hall's *Turbo paludinaeformis*, of Fremont's Report, might have been founded upon a young or imperfect specimen of this species, but the fact that that shell occurs in a yellowish-gray limestone showing sometimes an oolitic structure, and also containing Prof. Hall's *Cerithium nodulosum* (a true *Goniobasis*), shows that it must belong to a different horizon from the shell here under consideration, which comes from the oldest tertiary beds of the Bear River country, holding, according to Dr. Hayden's examinations, a position below the yellowish-gray limestone beds of that region.

*Locality and position.* Gilmore, Wyoming (Mr. Durkee); Bear River near the mouth of Sulphur Creek, Utah (Col. Simpson); and at various localities in the Bear River country (Dr. Hayden). It is always associated with *Corbula pryriiformis*, *Pyrgulifera humerosa*, *Corbicula Durkei*, and *Unio priscus*; none of which have been identified among the specimens from the higher beds of that district.

**VIVIPARUS? WYOMINGENSIS, Meek.**

Shell obliquely conoid-subovate; spire conical, with slightly convex slopes; apex rather pointed; volutions six, those of the spire obliquely compressed convex, last one large, a little compressed on the upper slope, but rounding over the middle, and somewhat produced below; suture well defined, but not deep; aperture ovate; lip not thickened on the inner side below, and apparently very faintly dilated around the outer side, at the

[ the *Helicidæ*, with which I am not familiarly acquainted. Another reason for suspecting that this might be the case is, that we have from the same formation, somewhat farther northward, another similar but more depressed form (*H. veterna*, M.), which has the same kind of surface-markings, with a slightly but unmistakably reflexed outer lip; while this latter shell stands, as it were, exactly intermediate in form between the still more depressed *H. Leidyi*, H. & M., from the White River territory, and that under consideration. That these latter two shells (*H. Leidyi* and *H. veterna*) really belong to some section of the genus *Helix*, there seems to be no reason to doubt.

Although believing the form under consideration to be related to the two species last above mentioned, its unusually elevated spire left me in doubt respecting its affinities. Consequently I sent the best specimen in the collection (which, however, is a cast retaining none of the shell) to Mr. Tryon, of Philadelphia, who has studied the existing land and fresh-water *Gasteropoda* with much care, and requested him to give me the benefit of his opinion in regard to its relations; and he writes that he doubts the propriety of viewing it as a land shell, or at least that he thinks that if it be, it cannot belong to any of the existing North American groups. He rather inclines to think it a *Viviparus* allied to *V. Japonica*, a species now inhabiting the streams of Japan. It certainly has much the form of that species, though more depressed.

Without being entirely sure that it belongs to that genus, I have concluded to refer the species provisionally to *Viviparus*. If a land shell, it would seem to be related to some section of the genus *Cochlostyla*, though probably not even then belonging to any of the recent groups ranged under the same.

*Locality and position.* Henry's and Black's forks, Church Buttes, &c., Wyoming; Middle Territory.

#### ISOCARDIA? HODGEI, Meek.

Shell cordate-subtrigonal, very gibbous; length and height nearly equal; beaks elevated, gibbous strongly involute, and placed in advance of the middle; posterior dorsal side of valves convex; incurved and sloping rather abruptly backward from near the umbones; anterior side very abruptly truncated by a broad, well-defined, large concave, cordate lunule, extending with the

1871.]

curve of the beaks to their points, and downward to the anterior basal angle; while within this area there is a smaller, deep, and sharply defined impression, or second lunule, under the beaks; basal margin forming a nearly semiovate curve from the lower extremity of the large lunule to the posterior end of the valves. Surface ornamented by small, nearly regular radiating costæ, separated by rather broader furrows; the whole being crossed by larger concentric ridges and furrows, which become smaller, more regular, and rather more distinct on the large lunule, where there are no radiating costæ.

Length and height, each 1 inch; convexity, 0.86 inch.

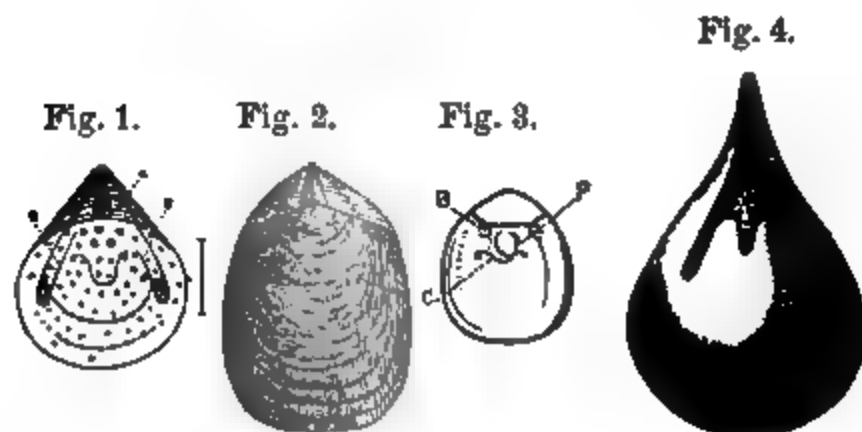
Of this curious form I have seen but one specimen, which is in the condition of an internal cast. The shell itself must be very thin, as the surface-markings are quite distinct on the cast. In general form, and its strongly incurved beaks, it reminds one of *Isocardia*, but its radiating costæ, and very large lunule-like cordate impression occupying the whole anterior end of the shell, are peculiar characters, I believe unknown in that genus. In addition to these features, its hinge would seem to have been without the teeth of *Isocardia*, so far as can be determined from the internal cast. From these facts I strongly suspect that it will be found to belong to an undescribed genus. If so, I would propose for it the name *Procardia*, in allusion to the distinctly heart-shaped impression occupying the whole anterior end. This species is evidently related to *Cardium? decussatum*, Mantell, and must belong at least to the same group. It is much smaller,



NOTICE OF A NEW BRACHIOPOD FROM THE LEAD-BEARING ROCKS  
AT MINE LA MOTTE, MISSOURI.

BY F. B. MEEK.

LINGULELLA LAMBORNI, Meek.



1. *Lingulella Lamborni*; being a view of the area and interior of a ventral valve, enlarged to  $2\frac{1}{2}$  diameters. *s, s*, are lateral internal scars, and (*a*) the area with its mesial furrow for the peduncle.

2. *Lingulella Danteti*; being an internal cast of the dorsal valve, with a view of area of the ventral valve and its mesial furrow. Nat. size, after Mr. Davidson.

3. An outline internal view of another specimen of same species, showing internal scars as understood by Mr. Salter; *C*, being supposed to represent the anterior retractors; and *B*, on each side, the sliding muscles. Nat. size, after Mr. Salter.

4. *Lingulella pinniformis*; being a view of internal cast of a ventral valve, showing the trilobate scar within. Enlarged about 2 diam. From N. Y. Regents's 16th State Cab., Nat. Hist. Report, pl. 6, fig. 16, for comparison with fig. 1

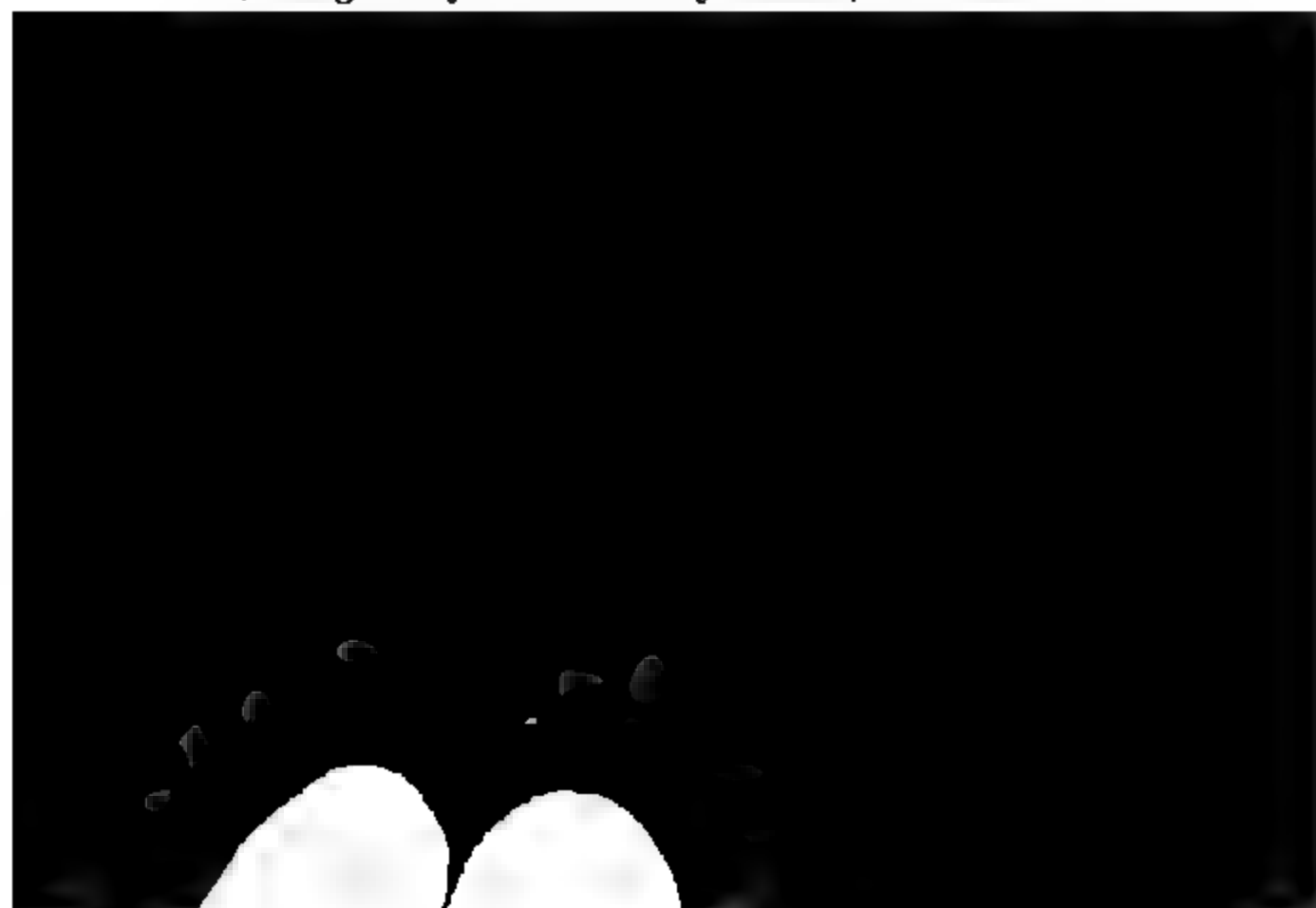
Shell small, compressed, broad-subovate, being about one-fifth longer than wide. Ventral valve pointed at the beak, from which the nearly straight lateral slopes diverge at an angle of about  $35^{\circ}$ , to near the middle of each lateral margin, from near which these margins round forward into the regularly rounded front; false cardinal area well developed, and extending back with the beak nearly one-fourth the length of the valve behind that of the other valve, and having its mesial furrow for the peduncle well defined, with on each side of it a diverging longitudinal line extending from the apex of the beak, so as to form the margins of the false area, which is transversely striated; interior marked by numerous little irregularly scattered pits, which are largest posteriorly and diminish in size forward; while near the anterior margin very obscure traces of minute radiating striae are sometimes seen; internal scars presenting a trilobate appearance, 1871.]

there being a short mesial rounded lobe nearly reaching the middle of the valve, and near half way between this and each posterior lateral margin, there is a long, slender, diverging lateral lobe or impression. Dorsal valve shorter than the other, and subcircular in form, its beak being apparently a little truncated; interior showing the same pitted appearance seen in the other valve; visceral and muscular impressions unknown. Surface of both valves marked by fine concentric striae.

Length, 0.26 inch; breadth, 0.22 inch; convexity, about 0.04 inch.

From the foregoing description and illustrations, it will be seen that this shell agrees exactly in the nature of its pitted interior, and in its furrow in a triangular false area, for the reception of the peduncle, with the type of Mr. Salter's genus *Lingulella* (*L. Davisii*, Salter). The scars of the interior, however, do not agree with the muscular impressions as made out by Mr. Salter (see the cut fig. 3, reproduced from one of Mr. Salter's figures). Still, as Mr. Davidson says, he could not see these impressions as Mr. S. represented them, even on carefully examining his typical specimens; it is quite probable that the latter gentleman, although a careful, conscientious observer, may not have made them out exactly right, especially as they are said by Mr. Davidson to be *very* dimly defined.

I have represented, in fig. 1, these scars of the interior of the ventral valves as they *appear* to be in the form under consideration, though they are obscurely defined, and seem to me to be



interior seen in our shell and the type of *Lingulella*; and so far as I have been able to determine, from examining casts of *Lingulepis*, they do not appear to have possessed a false area with a furrow for the peduncle, seen in the shell under consideration and in Mr. Salter's type.

Compared with Mr. Salter's type (*L. Davisii*), as illustrated by Mr. Davidson, our shell will be readily distinguished specifically, by its much smaller size, proportionally shorter form, more pointed beak, and less straightened lateral margins. The interior of its ventral valve also shows no traces of a small ridge indicated by a linear furrow in the internal casts of Mr. Salter's species.

*Locality and position.* The specimens were discovered by Robert H. Lamborn, Esq. (after whom I have named the species), in a thin bed of shale between two beds of limestone bearing heavy deposits of galena, at Mine La Motte, Madison Co., Missouri. They were sent by that gentleman to Prof. Leidy, of Philadelphia, and by him referred to me for study. I am not acquainted with the age of the rocks at Mine La Motte, never having seen any other fossils from there, but from the affinities of this single fossil to *Lingulella* from the Lingula flags of Wales, and to *Lingulepis* from the Potsdam sandstone of Minnesota, it would seem that these lead deposits belong to a much older period than the Galena and Dubuque lead-bearing limestone, of Illinois and Iowa, although the latter is known to belong to the Lower Silurian.

## DESCRIPTION OF THREE NEW SPECIES OF EXOTIC UNIONIDE.

BY ISAAC LEA.

*Unio Jeffreysianus.*

Testa crebre et leviter sulcata, regulariter elliptica, compressa, parum inæquilaterali; valvulis crassiusculis, antice parum crassioribus; natibus prominulis; epidermide tenebroso-fusca, polita, eradiata; dentibus cardinalibus parvis, lamellatis, obliquis; lateralibus longis, lamellatis subrectis et in utroque valvulo simplicibus; margarita vel alba vel salmonis colore tincta.

*Hab.* Australia, C. M. Wheatley.

*Unio Stevensii.*

Testa bialata, valde plicata, triangulari, compressa, valde inæquilaterali; valvulis crassiusculis; antice crassioribus; natibus vix prominentibus; epidermide tenebroso-cornea, eradiata; dentibus cardinalibus parvis sulcatisque; lateralibus longis; lamellatis subcurvisque; margarita alba et iridescente.

*Hab.* Yuruari River, Tributary to Essequibo River, Guiana, R. P. Stevens.

*Anodonta exillor.*

Testa alata, lævi, obovata, inflata, valde inæquilaterali; valvulis exilissimis; natibus prominulis, ad apices minute undulata; epidermide vel olivacea vel brunnea, polita et eradiata; margarita cœrulea et valde iridescente.

## DESCRIPTIONS OF TWENTY NEW SPECIES OF UNIONES OF THE UNITED STATES.

BY ISAAC LEA.

**Unio Lawii.**

Testa lævi, obliqua, clavæformi, antice tumida, valde inæquilaterali, postice obtuse angulata; valvulis crassis, antice aliquanto crassioribus; natibus prominentibus, fere terminalibus; epidermide flavida, radiis interruptis indutis; dentibus cardinalibus parviusculis, acuminatis crenulatisque; lateralibus sublongis, subcurvis lamellatisque; margarita argentea et iridescente.

*Hab.* Tennessee River, Tuscumbia, Alab., B. Pybas. Tenn. River, Dr. Edgar. Holston River, Miss A. E. Law and Prof. Cope.

**Unio appressus.**

Testa lævi, triangulari, securiformi, valde inæquilaterali, antice rotundata, postice subangulata; valvulis crassiusculis, antice aliquanto crassioribus; natibus prominentibus; epidermide flavida, radiis interruptis postice indutis; dentibus cardinalibus parviusculis, compressis crenulatisque; lateralibus sublongis, curvis lamellatisque; margarita argentea et aliquanto iridescente.

*Hab.* Tuscumbia, Alab., B. Pybas and J. G. Anthony. Holston River, Miss Law and C. M. Wheatley.

**Unio validus.**

Testa lævi, triangulari, inflata, inæquilaterali, antice rotunda, postice obtuse angulata; valvulis crassis, antice aliquanto crassioribus; natibus prominentibus, ad apices undulatis; epidermide olivacea, valde radiata; dentibus cardinalibus crassis, compressis crenulatisque; lateralibus sublongis, crassis subcurvisque; margarita argentea et iridescente.

*Hab.* Duck River, Tenn., Dr. Powell. Clinch River, Pres. Estabrook. Holston River, Dr. Edgar and Miss Law.

**Unio litus.**

Testa lævi, elliptica, subcompressa, inæquilaterali, antice rotundata, postice subbiangulata; valvulis subtenuibus, antice crassioribus; natibus prominulis; epidermide crocea, eradiata; dentibus cardinalibus parvis compressisque; lateralibus sublongis, sub-

1871.]

curvis lamellatisque; margarita salmonis colore tincta et elegantissime iridescente.

*Hab.* Cahaba River, Shelby Co., Alab., E. R. Schowalter, M.D.

*Unio simulans.*

Testa lævi, obliqua, subcompressa, inæquilaterali, antice rotundata, postice obtuse angulata; valvulis crassiusculis, antice crassioribus; natibus prominulis; epidermide tenebroso-fusca, eradiata; dentibus cardinalibus parvis, compressis crenulatisque; margarita alba et iridescente.

*Hab.* Cahaba River, Shelby Co., Alab., E. R. Schowalter, M.D.

*Unio Cahabensis.*

Testa valde tuberculata, quadrata, compressa, subæquilaterali, antice rotunda, postice truncata; valvulis subcrassis, antice crassioribus; natibus subprominentibus; epidermide crocea, eradiata; dentibus cardinalibus subgrandis, compressis crenulatisque; margarita salmonis colore tincta et elegantissime iridescente.

*Hab.* Cahaba River, Shelby Co., Alab., E. R. Schowalter, M.D.

*Unio acutens.*

Testa lævi, triangulari, compressa, valde inæquilaterali, antice rotundata, postice subbiangulata; valvulis crassiusculis, antice crassioribus; natibus prominentibus; epidermide luteola, radiis interruptis; dentibus cardinalibus subcrassis, subcompressis crenulatisque; lateralibus subcrassis, brevis subrectisque; margarita alba et iridescente.

*Hab.* Holston River, near Concord, E. Tenn. Miss. Low.

**crassis, antice crassioribus; natibus elevatis, subretusis; epidermide luteo-oliva, perradiata; dentibus cardinalibus parviusculis, subcompressis crenulatisque; lateralibus curtis, subcrassis subrectisque; margarita argentea et iridescente.**

*Hab.* Tuscumbia, Alab., L. B. Thornton, Esq. Holston River, E. Tenn., Dr. Edgar.

***Unio dispansus.***

**Testa lævi, elliptica, subinflata, valde inæquilaterali, antice rotunda, postice obtuse angulata; valvulis crassiusculis, antice crassioribus; natibus prominulis, fere terminalibus; epidermide tenebroso-olivacea, perradiata; dentibus cardinalibus parviusculis, tuberculatis et in utroque valvulo duplicibus; lateralibus prælongis, lamellatis subrectisque; margarita purpurea et valde iridescente.**

*Hab.* East Tennessee, Dr. Edgar.

***Unio Pealei.***

**Testa lævi, rotunda, valde inflata, subglobosa, valde inæquilaterali, antice et postice rotundata; valvulis crassis, antice crassioribus; natibus elevatis, tumidis, subretusis; epidermide luteo-olivacea, dilute perradiata; dentibus cardinalibus parviusculis, subconicis; lateralibus longis crassis subrectisque; margarita argentea et iridescente.**

*Hab.* Topeka, Kansas, Chas. W. Peale.

***Unio globatus.***

**Testa lævi, globosa, valde inæquilaterali; valvulis crassis, antice crassioribus; natibus valde inflatis, parum elevatis; epidermide tenebroso-fusca; dentibus cardinalibus percrassis et valde corrugatis; lateralibus curtis, crassis, parum curvatis corrugatisque; margarita argentea et iridescente.**

*Hab.* Holston River, Dr. Edgar. Etowah River, Geo., Thos. Bland.

***Unio subglobatus.***

**Testa lævi, suborbiculata, inæquilaterali; valvulis percrassis; natibus tumidis, elevatis, incurvis; epidermide tenebroso-fusca, ad apices maculata et radiata; dentibus cardinalibus parviusculis, compressis sulcatisque; lateralibus crassis, curvatis corrugatisque; margarita argentea et iridescente.**

*Hab.* Florence, Alab., B. Pybas. Nashville, Tenn., Pres. J. B. Lindsley.

1871.]

*Unio recurvatus.*

Testa lævi, rotundata, valde inflata, valde inæquilaterali; antice rotundata, postice obtuse angulata; valvulis crassis, antice crassioribus; natibus valde prominentibus et recurvatis; epidermide fusca, eradiata; dentibus cardinalibus parvis, crassis sulcatisque; lateralibus percrassis, curtis, subcurvis corrugatisque; margarita argentea et iridescente.

*Hab.* Tenn. River, J. G. Anthony. Holston River, E. Tenn., Miss Law.

*Unio obtusus.*

Testa lævi, triangulari, subinflata, ad basim arcuata, inæquilaterali, antice rotunda, postice obtuse angulata; valvulis crassis, antice crassioribus; natibus prominentibus; epidermide dilute oliva, perradiata; dentibus cardinalibus parvis corrugatisque; lateralibus crassis, lamellatis corrugatisque; margarita argentea et iridescente.

*Hab.* Tuscumbia, Alab. Holston River, E. Tenn., Miss Law.

*Unio radiosus.*

Testa lævi, subtriangulari, subinflata, subequilaterali, antice rotundata, postice obtuse angulari; valvulis crassiusculis, antice parum crassioribus; natibus prominentibus; epidermide luteo-oliva, perradiata; dentibus cardinalibus parvis, compressis crenulatisque; lateralibus subcrassis, lamellatis subrectisque; margarita alba et iridescente.

*Hab.* Holston River, E. Tenn., C. M. Wheatley and Miss Law.



dentibus cardinalibus parvis, subcompressis crenulatisque; lateralibus longis, lamellatis subcurvisque; margarita alba et iridescente.

*Hab.* Ogeechee River, Liberty Co., Geo., Major John Le Conte.

***Unio pattinoides.***

Testa lævi, obliqua, subcompressa, valde inæquilaterali, antice rotundata, postice obtuse angulata; valvulis subcrassis, antice crassioribus; natibus subprominentibus, fere terminalibus; epidermide luteo-brunnea, maculata; dentibus cardinalibus parvis, subcompressis corrugatisque; margarita argentea et iridescente.

*Hab.* Clinch River, Pres. Estabrook. Holston River, Dr. Edgar and Miss Law.

***Unio santeeensis.***

Testa lævi, suboblunga, subinflata, valde inæquilaterali, antice rotundata, postice obtuse biangulata; valvulis crassiusculis; natibus prominulis, ad apices minute undulatis; epidermide tenebroso-fusca, nitida et valde radiata; dentibus cardinalibus parvis, compressis et in utroque valvulo duplicibus; lateralibus longis subcurvisque; margarita vel purpurea vel salmonis colore tincta et iridescente.

*Hab.* Santee Canal, S. C., Dr. Foreman. Oconee River, Geo., Major J. Le Conte.

**SYNOPSIS OF THE GENUS CHETTUSIA (LOBIVANELLUS), WITH A  
DESCRIPTION OF A NEW SPECIES.**

BY J. A. OGDEN.

The species belonging to the genus *Chettusia* are recognized by their moderately strong bill, the culmen somewhat depressed at the base, with the sides compressed and grooved for two-thirds their length; nostrils lateral, basal, with the opening linear; wings long, with the first, second, and third quills nearly equal and longest; the shoulder of the wing more or less armed with a tubercle or spine; tail broad and even; tarsi moderately long, exceeding the length of the middle toe; toes four; head not crested, and sometimes more or less lobed.

*a.* Species with wattles well developed; tubercle upon the wing prolonged into a spur, or spine; hind toe short.

**1. *C. senegalla* (Linn.).**

*Parra senegalla*, Linn., Syst. Nat. I., p. 259.

*Vanellus albicapilla*, Vieill., Nouv. Dict. d'Hist. Nat. XXXV., p. 205.

*Vanellus senegalensis*, Shaw, Gen. Zool. XI., 2, 515.

*Vanellus strigilatus*, Swains., B. of W. Afr. II., p. 241, pl. 27.

*Vanellus albifrons*, Rüpp., Pl. enl. N. 862; Reich., pl. C. figs. 682-88.

*Hab.* Western Africa (Swainson).

(Collection of the Academy.)

**2. *C. macronotus* (Cuv.).**



**4. C. personata** (Gould.).

*Lob. personata*, Gould., Proc. Zool. Soc., pt. X., p. 113. B. of Aust. fol., vol. vi., pl. 10; Reich. CIII., 1055-56.

*Hab.* Northern Australia (Gould).

(Collection of the Academy.)

**5. C. lateralis** (Smith).

*V. lateralis*, Smith., Zool. S. Afr., pl. 23.

*Hab.* South Africa (Smith).

(Collection of the Academy.)

*b.* Species with wattles not so well developed; wing armed with a short tubercle, otherwise the same as in the previous species.

**6. C. inornatus** (Schlegel.).

*Lob. inornatus*, Schlegel., Fauna Jap., p. 106, pl. 63.

*V. inornatus*, Swains.

*C. Wagleri*, Bonap.

*Hab.* India (Jerdon).

(Collection of the Academy.)

**7. C. melanocephala** (Rüpp.).

*Lob. melanocephala*, Rüpp., Syst. Übers., p. 115, pl. 44.

*Hab.* Northern Africa (Rüpp.).

(Collection of the Academy.)

**8. C. goensis** (Gmel.).

*Parra goensis*, Gmel., Syst. Nat. I., p. 706.

*Lob. goensis*, Strick.

*V. indicus*, Bodd.

*Ch. atrogularis*, Wagl., Syst. Av. sp. 49; Pl. enl. 807; Gould, Cent. of Birds, pl. 78.

*Hab.* India (Jerdon).

(Collection of the Academy.)

**9. C. atronuchalis** (Blyth.).

*Lob. atronuchalis*, Blyth., Journ. Asiatic Soc. of Bengal.

*Hab.* Burmah (Blyth.).

*c.* Species devoid of wattles at the base of the bill; tubercle upon the wing rudimental; otherwise the same as in the previous species.

**10. C. gregaria** (Pall.).

*Ch. gregaria*, Pallas., Reise I., p. 456, No. 9.

*Ch. ventralis*, Wagl., Ill. Ind. Zool., pl. .

*V. Keptuschka*, Temm., Gould., B. of Europe, pl. 292.

*P. cinereus*, Blyth., Journ. Asiatic Soc. of Bengal, p. 587, 1842.

*Hab.* India (Jerdon); Europe (Gould); Central Asia (Pallas).

(Collection of the Academy.)

1871.]

11. *C. leucurus* (Licht.).

*V. leucurus*, Licht., Eversm., Reise. Nach. Buch, p. 137.

*V. fascipes*, Sav. L'Egypt. Zool., pl. 6, fig. 2.

*Hab.* Middle Asia; N. Africa; rare in India (Blyth.).

(Collection of the Academy.)

12. *C. crassirostris* (Hart.). Cabanis Journal III., p. 427.

*Hab.* Borders of the Nile (Hart.).

13. *C. aralensis* (Eversman.).

*V. aralensis*, Evers., Bull. Mosc., 1858, p. 497.

*Hab.* Russia (Evers.).

14. *C. dominicana* (Linn.).

*Para dominicana*, Linn., Syst. Nat., p. 705.

*Ch. Brissonii*, Wagl., Syst. Av., sp. 55.

*Hab.* St. Domingo (Linn.).

15. *C. ludoviciana* (Gm.).<sup>1</sup>

*Parra ludoviciana*, Gm., Syst. Nat., p. 706.

*V. miles*, Bodd.

*Ch. callas.*, Wagl. Syst. Av., sp. 52.

*Hab.* Amboina (Forster).

16. *Chettusia nivifrons*, nov. sp. Plate I.

Fore part of head extending to the occiput, including the sides and foreneck white; the occiput, nape, and breast bluish-black; the remaining under parts, upper tail coverets, large and small wing coverets are also white, back and scapulars, light brownish-

JULY 4, 1871.

Prof. MACTIER in the chair.

Eight members present.

*Remarks on Donation of Fossils from Wyoming.*—Prof. LEIDY directed attention to the collection of fossils presented this evening by Dr. Joseph K. Corson, stationed at Fort Bridger, Wyoming Territory. The fossils, consisting of remains of mammals, turtles, and crocodiles, were obtained at Grizzly Buttes, in the vicinity of Fort Bridger. Among the mammalian fossils are many pertaining to *Palæosyops paludosus*, consisting of portions of the skull, jaws with and without teeth, articular extremities of the limb bones, etc. Dr. J. Van A. Carter had recently sent to Prof. Leidy some well-preserved portions of jaws with teeth, of the same animal, from Lodge-pole-trail, thirteen miles from Fort Bridger, and also from Henry's Fork of Green River. Among the specimens from the latter locality, there is the most complete series of the upper molar teeth which he had yet seen.

The specimens of jaws and teeth indicate a variation in the size of *Palæosyops*. The molar series of teeth further undergo a rapid reduction in size from behind forwards, so that from isolated specimens of teeth, the smaller anterior molars might readily be viewed as pertaining to a smaller species. Prof. Marsh had recently designated what he supposed to be a smaller species of *Palæosyops* with the name of *P. minor*, from an inferior molar tooth, "apparently from near the middle of the series." The measurements which he gives to the tooth, ten lines fore and aft, and five lines in front, and five and sixteenths behind, at the summit of the lobes, would apply to the first true molar of *P. paludosus*, while the last premolar is still smaller.

In a nearly complete ramus of the lower jaw of *P. paludosus*, a series of teeth, consisting of the true molars and the two premolars in advance, measures 64 lines. Another series of true molars measures 46 lines. These measure in succession fore and aft, 11 lines, 15 lines, and 19 lines. The last premolar, looking like a reduced molar with the hinder lobe proportionately less well developed, measures scarcely 9 lines.

## JULY 11.

The President, Dr. RUSCHENBERGER, in the chair.

Sixteen members present.

The following paper was presented for publication:—

"Contributions to the Herpetology of Tropical America. No. 9." By Edw. D. Cope.

The publication of pp. 89 to 120 of the Proceedings for 1871 was announced.

The death of Wm. P. Turnbull was announced.

## JULY 18.

The President, Dr. RUSCHENBERGER, in the chair.

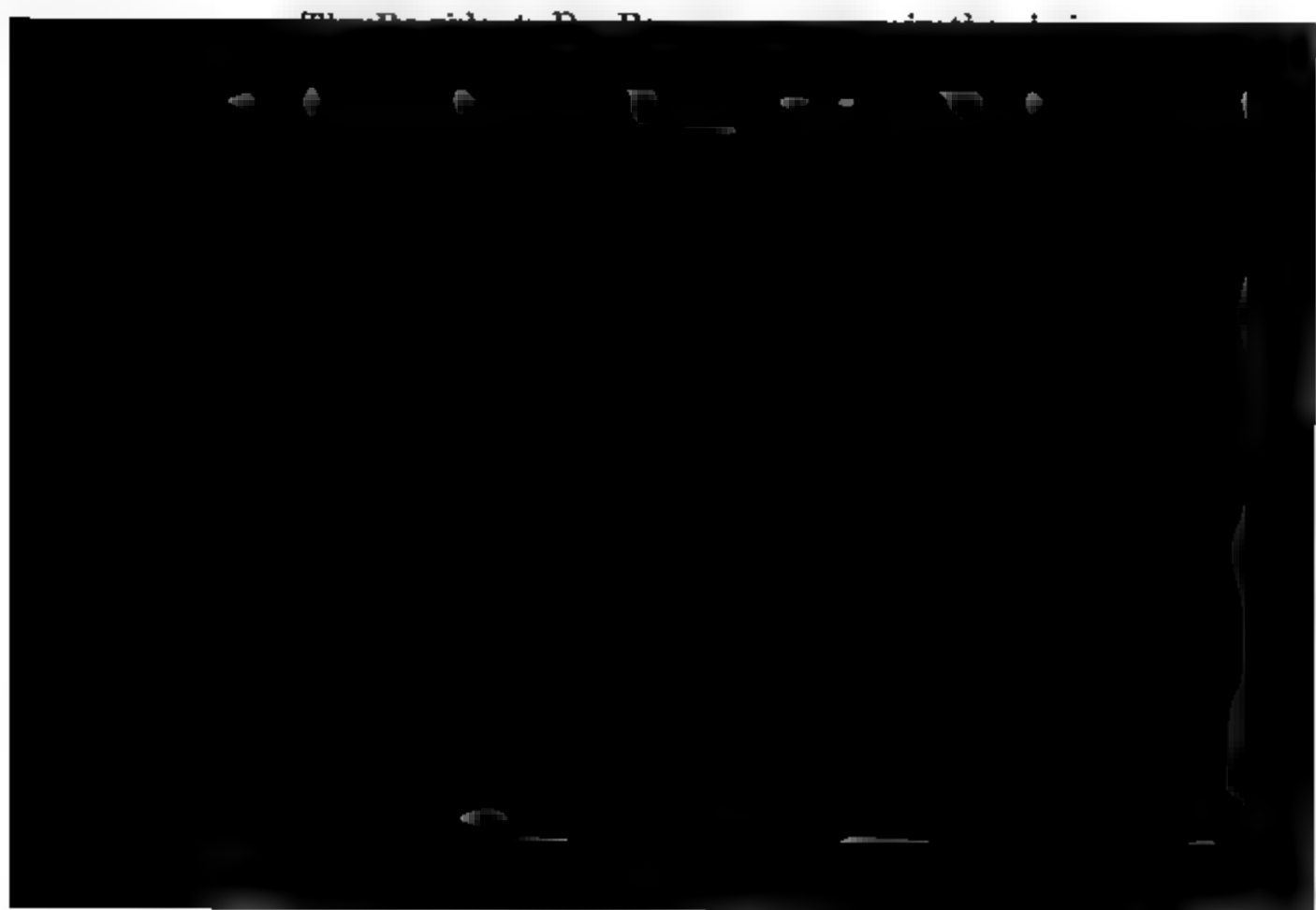
Thirteen members present.

The following paper was presented for publication:—

"Descriptions of five new species of Crustacea from Mexico." By T. Hale Streets.

The publication of pp. 121 to 136 of the Proceedings for 1871 was announced.

## AUGUST 1.



localities of the former, and nine of the latter, most of which he has visited.

The fragment of a tusk, from Stanislaus Co., referred to *Mastodon Shepardi*, Dr. Yates found imbedded in the bluff of a hill about ten feet above the bed of a creek. The hill, upwards of a hundred feet in height, is one of the tertiary hills mentioned in Whitney's Geological Report, as being scattered over the plain of San Joaquin, at the base of the foot-hills of the Sierra Nevada.

The remains of the *Mastodon* of Contra-Costa Co. were obtained from the rock at the base of one of the rounded hills, of tertiary age, mentioned in Whitney's Report, pp. 31, 32, near the edge of the San Joaquin Plains, which skirt along the foot-hills of Monte Diablo.

A small photograph, accompanying Dr. Yates' letter, represents a much mutilated lower jaw, without the ascending portions posteriorly, and with straight tusks projecting with an upward direction. The tusks appear to be quite as long as the jaw has been in its complete state. No details of character are given in relation to the specimen.

*Note on Anchitherium.*—Prof. Leidy also exhibited a specimen recently received from Prof. Hayden, who discovered it on the head waters of the Jefferson Fork of the Missouri River. It consists of a portion of the lower jaw, apparently of a species of *Anchitherium*, larger than *A. Bairdi*, and relating in size to a mutilated molar, from John Day's River, Oregon, referred to *A. Condoni* (Pr. 1870, 112), and may, perhaps, pertain to the same species.

On motion the following papers were ordered to be published:—

## NINTH CONTRIBUTION TO THE HERPETOLOGY OF TROPICAL AMERICA.

BY E. D. COPE.

THE materials examined, from which the present contribution is derived, are contained in six collections, viz: One made by the U. S. Expedition for the exploration and survey of a canal route across the Isthmus of Darien, under Commander Selfridge; a second by the U. S. Exploring Expedition to survey a canal route across the Isthmus of Tehuantepec, under Captain Shufeldt, made by Dr. T. Hale Streets, who accompanied it as naturalist— which collections were placed in my hands for determination by Prof. Henry, of the Smithsonian Institution; a third by John Hauxwell, our correspondent at Pebas, Eastern Equador; and a fourth made in the southeastern part of the Island of Hayti, in the republic of Santo Domingo, by our member, Wm. M. Gabb.

I. The first of these collections embraces the following species:—

**LACERTILIA.**

*Geniodactylus*, sp. aff., *albigulari*.

*Corythophanes*, sp.

*Anolis squamulatus*, Peters, Monatsb. Pr. Ac. 1863, 145.

Auricular opening nearly as large as eye-slit; scales smallest; seven rows between orbits, twelve at middle of muzzle, and eleven at middle of lores, the inferior not larger than the rest. No larger supra-orbital and infra-labial scales; scales of arm, back and tail,

*Himantodes cenchoa*, L.

*Oxyrrhopus occipitoluteus*, D. B.

*Nothopsis rugosus*, Cope, gen. et. sp. nov.

**DROMICUS IGNITUS**, Cope.

Posterior superior maxillary tooth scarcely longer than those preceding, but separated by a marked interspace. Scales in seventeen longitudinal series. Form slender, head little distinct. Rostral plate scarcely visible from above; common internasal suture considerably shorter than frontal shield, which is shorter than common suture of occipitals. Length of muzzle to orbit, equal width of frontal and one superciliary. Dorsal longer than high. Orbitals 2-2, in one case by median division, in another by inferior intercalated between labials. Temporals 1-1½, the first occupying the whole space between occipital and seventh labial. Eight superior labials, fourth and fifth in orbit; nine inferiors; geneial pairs subequal. Gastrosteges 128; urosteges, 62 + (the end lost, at least fifteen urosteges wanting).

Color brown above, blackish along the sides throughout, up to the middle of the fifth row of scales, then a very bright brown, commencing abruptly and shading to a deeper brown on the median region of the back. The light margin becomes a white line on the anterior fifth of the length, which extends to the orbit. Upper lip and throat light yellow, rest of inferior surfaces, dark crimson; a black dot on the end of each gastrostege. Scales dusted with black. Length restored? 15.5 inches; to vent, 10 inches.

This serpent is allied to the *D. tæniatus* of Peters (Monatsberichte, Berl. Ac. 1863, 275), from Mexico.

**NOTHOPSIS RUGOSUS**, Cope, gen. et sp. nov.

Teeth on all of the usual bones of the mouth, wanting on the premaxillary. Maxillary teeth of equal lengths, entire. Head flat, oval, moderately distinct; body and tail compressed. Urosteges in two rows, anal shield entire, gastrosteges narrow, angulate, the ends crossed by a longitudinal groove; pupil round. Head covered with small scales above, except a pair of internasals in contact with nasals and rostral; an isolated median frontal, and a pair of small oval occipitals, each also entirely surrounded by small scales. A single nasal pierced by the nostril; loreals

like other head scales, orbit surrounded by scales, labials not pitted. One pair of geneials. Scales of body subequal, keeled, without apical pores.

The above generic characters will indicate to the zoologist a type of whose affinities I have been quite uncertain. Its superficial characters remind one at once of the *Peropoda*, and the double urosteges suggest the *Pythons*. Examination shows that it does not possess the essential characters of the division, lacking all external trace of posterior extremities, and having the mandible constructed on the Colubrine type, thus lacking the coronoid bone. The form of the postfrontal bone is, however, significant; it is of considerable size, and sends forwards along the external margin of the frontal a process, as far as the prefrontal. This structure is characteristic of the family *Achrochordidæ*,<sup>1</sup> which embraces the genera *Chersydrus* and *Achrochordus*. The present genus differs in the possession of ventral shields, wherefore it may be referred to a new family under the name of the NOTHOPIDÆ. I should not be surprised to find that the genus *Xenodermus* of Reinhardt belongs to it.

The allies of this genus, then, are exclusively Old World, and confined to farther India and the Archipelago.

*Char. Specif.*—Head rather small; neck and tail rather slender. Scales of body in twenty-nine rows, all strongly keeled, those of the seven median rows a little broader than the lateral, and more strongly keeled. The scales of the inferior series are more acute than the superior. A broad shallow groove extends throughout

pair and geneials separated by a median longitudinal groove; latter plates 2.5 times as long as wide; remainder of gular region covered with small scales. Internasals together crescentic, the points extending to behind the nostrils. Frontal broad cordate, the apex posterior; a half suture from the front divides it. Occipitals narrow, length equal from muzzle to frontal, greater than width of latter. They are separated by a single series of small scales, in contact at one point. Gastrosteges 158, anal 1; urosteges 1 entire, 55 divided, and probably 10 wanting from the loss of the extremity. The section of the tail is compressed, pentagonal. Length, .381 M.; to vent, .225; to rictus oris, .001.

The ground color is brown, which is yellowish on the sides, dark on the vertebral region, darker anteriorly, and almost black on the head. The sides are marked from the second to the tenth series of scales with dark brown yellow bordered triangles, apices upwards, three in an inch; the bases scooped out and with the legs sometimes cut off. A series of subquadrate blackish spots separates their apices along the median line; these sometimes divide, and the halves alternate. Head unspotted, upper and lower lips with lateral ventral groove ochre-yellow. Belly clearer yellow, with several series of small deep brown marking. Outer ends of urosteges blackish, anal shield black.

The above description indicates how closely this serpent resembles in coloration the young examples of *Trigonocephalus atrox* from the same country, and the *T. neovidii* of Brazil. This is so marked as to constitute a case of mimetic analogy. But few cases of mimicry of the Crotaline venomous snakes are to be observed in South America, the imitations being chiefly of the other venomous group *Proteroglypha*, as represented by *Elaps*. In this connection may be made a

*Reclamation*, of the discovery of this, perhaps the most extensive example of mimetic analogy known in zoology. Alfred R. Wallace, in his admirable work, "Contributions to the Theory of Natural Selection," London, 1870,<sup>1</sup> gives Dr. Günther as his authority for the facts of the case with regard to the genera *Pliocercus* *Oxyrrhopus*, *Erythrolamprus*, etc., and refers to his own previously published account of it in one of the British Reviews for 1869. The first published account of the case will be found

<sup>1</sup> Wallace is quoted by Darwin in "Descent of Man," to the same effect.

in the "Proceedings of the Academy of Natural Sciences, Philadelphia," 1865, 199, in a paper by the author; although attention had been called to it in the same publication for 1860, p. 262.

It was repeated and extended in "Origin of Genera," 1868, but had been already pointed out in conversation with Dr. Wallace, and probably Dr. Günther also, in London, in 1863, a fact which had probably escaped his memory.

II. Examination of a collection of reptiles and fishes brought from near San José, Costa Rica, by Dr. Van Patten. The collection embraced forty-one of reptiles, six of batrachia, and nine of fresh-water fishes from the Rio Grande. The facies of this part of the fauna may be seen in the following list:—

#### OPHIDIA

*Candisora durima*, L.

*Bothrops atrox*, L.

*Bothriechis affinis*, Bocourt.

*Bothriechis nigroviridis*, Peters.

*Elaps nigrocinctus*, Gird.

*Elaps ornatissimus*, Jan. var. with black annuli ten scales apart, nineteen on body, six on tail.

*Elaps multifasciatus*, Jan.

*Pelamis bicolor*, Daud.

*Drylophis brevirostris*, Cope.

*Drylophis acuminatus*, Wied.

*Thrasops ? mexicanus*, D. B.

*Lantognathus nebulatus*, L.

**Tantilla melanocephala**, Linn. Variety.  
**Stenorhina ventralis**, D. B.  
**Stenorhina degenhardtii**, Berth.  
**Ninia maculata**, Peters. Abundant.  
**Ninia atrata**, Hallow.  
**Colobognathus hoffmannii**, Peters. Abundant.  
**Colobognathus brachycephalus**, Cope, sp. nov.  
**Colobognathus dolichocephalus**, Cope, sp. nov.  
**Epicrates cenchria**, L.

### LACERTILIA.

**Anolis insignis**, Cope, sp. nov.  
**Anolis microtus**, Cope, sp. nov.  
**Anolis nannodes**, Cope, P. A. N. S., 1864, p. 173, var. with only five scales between the canthal rows on muzzle, and six rows of large smooth geneials.  
**Anolis hoffmannii**, Peters, Monatsber. Pr. Acad., 1863, 142.  
**Anolis trochilus**, Cope, sp. nov.  
**Sceloporus malachiticus**, Cope, Proc. Acad. Nat. Sci., Phila., 1864, 178.  
**Cyelura acanthura**, Wiegmann.  
**Phyllodactylus**.

### BATRACHIA.

**Trypheropsis chrysoprasinus**, Cope, Proc. Acad. Nat. Sci., Phila., 1866, 130; 1868, 117.  
**Atelopus varius**. Very abundant. The light spots on this species are crimson in life.  
**Bufo**.  
**Smilisca daudinii**, D. B.  
**Agalychnis moreletii**, Dum. Very abundant. Golden and green in life.  
 Descriptions of new species are appended."

### TELEURASPIDES.

This group of the rattlesnake family embraces those with undivided anal shields and no rattle. It stands immediately between the true *Trigonocephali* and the *Crotali*, as the former have divided caudal scutella and the rattle absent, the latter the rattle with simple scutella. One genus of this division was described long ago by Beauvois, and adopted by Gray and others, that is, the *Ancistrodon* of North America and Mexico, but most of the genera have only been recognized within a recent period. In March, 1859, Prof. Peters distinguished a second genus of the

1871.]

group, and, towards the close of the same year, the writer named a third. Prof. Peters subsequently named another genus which may be retained, though in a sense quite different from that in which it was originally intended. I allude to *Bothriopsis*, first defined by the four small scuta on the top of the muzzle of one of the species, a character not worthy of such a valuation. The characters adopted will be seen below. All the known species are found between North Mexico and Peru.

I. Head scaled above.

a. Body compressed, tail prehensile (*arboreal*).

A series of horn-like scales above the eye, outside of the superciliary shield.

TELEURASPIS.

Superciliary reaching to the edge of the eye opening, no horns.

BOTHRIECHIS.

aa. Body cylindric, tail straight (*terrestrial*).

Nasal plate one.

PORTHIDIUM.

Nasal plates two.

BOTHRIOPSIS.

II. Head with nine plates above.

Body cylindric; two nasals.

ANCISTRODON.

TELEURASPIS, Cope.

Proceed. Acad. Nat. Sci., Phila., 1859, 338; 1860, 345.

The species of this genus are few, and are so far only known from the Isthmus of Darien and west of the Andes to Peru.

*Teleuraspis schlegelii*, Berthold, Abh. wiss., Göttingen, 1847, iii 13 *Trigonotropha-*

**BOTHRIECHIS**, Peters.

Monatsber. K. Preuss. Academie, 1859, 278. Cope, Pr. A. N. Sci., Phil., 1859, 345. *Thamnocenchris*, Salvin.

This genus is, like the last, confined to the great forests of Central America and the northwest of South America. Species have been found further north than those of *Teleuraspis*. Like the latter, they inhabit trees, filling the place in America of the species of the East Indies which belong to the *Trigonocephali*, and of the tree-vipers of West Africa, *Atheris*, Cope. All the species of these different groups are of green colors, in contradistinction to those of terrestrial habits, which are of various shades of brown. This is evidently related to their convenience in the struggle for existence in the localities in question.

*Bothriechis nigroviridis*, Peters, l. c. Cope, l. c.

Costa Rica. A specimen from Dr. Van Patten's collection is peculiar in having the nasal shield to reach the labial border in front of the labials, and the superciliary shield transversely divided. In all other respects it agrees with Peters' description and figures.

*Bothriechis lateralis*, Peters. Monatsb. Preuss. Acad., 1862, 674. *Bothrops bilineatus*, Pet. l. c., 1859, 278. ? *Bothrops bicolor*, Bocourt, Ann. des Sci. Nat., 1868, p. 201.

Costa Rica.

*Bothriechis aurifer*, Salvin (*Thamnocenchris*). Proc. Zool. Soc., 1860, 459. Tab. pulcherrima !

Coban, Vera Paz.

**PORTHIDIUM**, Cope.

This genus is proposed to accommodate the *Bothrops lansbergii* and related species, which display characters intermediate in some respects between the last genus and *Bothriopsis*.

Scales in 23 rows. Rostral plate narrow, high; two or three scuta above canthus rostralis; superciliary wide. Body compressed. Dark brown crossbars alternating on sides. P. LANSBERGII.

Rostral higher; scales of vertex more elongate in front. P. NASUTUS.

*Porthidium lansbergii*, Schlegel, Magazine de Zoologie, 1841. Tab.

Tropical America.

*Porthidium nasutum*, Bocourt, Ann. Sci. Nat., 1868, p. 202 (*Bothrops*).

Guatemala.

1871.]

**BOTHRIOPSIS, Peters.**

Monatsber. Preuss. Acad., 1861, 359, emendatus.

The species of this genus are all of terrestrial habits, and approach, in this respect, the *Ancistrodontes*. They have a more extended range than any of the preceding, occurring from the upper or Peruvian Amazon to northern Mexico. They are very venomous, but not so much dreaded as the true *Trigonocephali* of the same regions, which attain a larger size.

**a. Superciliary shield wide.**

Scales in 21 rows, two inferior smooth; canthus rostralis with two scales only; two rows below eye; a series of brown dorsal rhombs.

**B. GODMANII.**

Scales in 23 rows; rostral a narrow vertical parallelogram; three scales on canthus; 2-3 rows below orbit. Light, with twenty-one or fewer broad brown crossbars, alternating on each side; mouth black.

**B. BRACHYSTOMA.**

Similar, but with forty quadrate spots on each side the middle line, with two rows of spots below them on each side.

**B. OPHTHYOMEGAS.**

**B. CASTELNAVI.**

**aa. Superciliary shields very narrow.**

**β. No small scales surrounding rostral.**

Scales in 23 ("25") rows, three inferior smooth; small scales on canthus, four rows below eye; rostral broad as high; nine superior labials, fourth largest. Twenty-two dorsal rhombs.

**B. AFFINIS.**

**ββ. Rostral separated from nasals by small scales**

**Bothriopsis castelnavii**, Dum. Bibr. Erp. Gen. vii. (*Bothrops*). Castelnau, Anim. Nouv. ou rares Am. Sud. Rept. Tab. Steindachner, Sitzungs. Wien. Acad., 1870, May. *Bothriopsis quadriscutatus*, Peters, Monatsb. 1851, 359.

Equador; Peru.

**Bothriopsis affinis**, Bocourt. Ann. Sci. Nat., 1860, 201. *Teleuraspis mexicanus*, Cope, Proc. A. N. S., 1859, 339. *Bothriechis*, do., Cope, l. c. 1860, 345, nec *Atropus mexicanus*, D. B.

Mexico, as far north as Tuxpan, and Central America to Costa Rica.

**Bothriopsis mexicanus**, Dum. Bibr. (*Atropus*). Erp. Gen. viii., p. 1521, Tab. 83 bis. *Atropus nummifer*, Rüppel, Verzeichn. Senck. Mus. Frankr. p. 21. *Teleuraspis*, do., Günther. Am. Magaz. Nat. Hist., 1867, March, Tab. iii., fig. C, nec Cope, Pr. A. N. S. Phila., 1859, 339, et 1860, 345 = *B. affinis*, Boc.

Rüppel's description is so brief and worthless as to be unfit for application to any species. I used it for what turns out to be the *B. affinis* of Bocourt, but Dr. Günther retains it for this one, believing it to be identical with the former. Bocourt first distinguished them, but they may prove to be the same; they are at least very closely allied.

Common in Mexico.

Numerous specimens of these species are in the collections of the Smithsonian Institution, chiefly obtained by Henry Hague, of Coban.

#### ANCISTRODON, Beauvais.

Trans. Amer. Philos. Soc. *Agkistrodon* and *Toxicophis* (Troost). Baird and Girard.

**Ancistrodon bilineatus**, Günther. Am. Magaz. Nat. Hist., Nov. 1863.

Guatemala; Tehuantepec. Coll. Smithsonian.

**Ancistrodon pugnax**, Bd. Girard. Catal. Serpents N. Amer., 18.

Texas.

**Ancistrodon piscivorus**, Catesb.

United States, from Texas to Virginia; the Mississippi Valley to south Illinois (Kennicott).

**Ancistrodon contortrix**, Linn.

North America. East of Rocky Mountains, from Texas inclusive of Massachusetts.

**Elaps multifasciatus**, Jan. Mag. Zool. 1859, pl. A.

An elongate species, with extremely short tail, and head rather

suddenly wider than the body, and with closely approximated broad black rings.

Tail one 22d or 3d of the total length, obtusely conic at the apex. Scales rather broad, in fifteen longitudinal rows. Head broad and short, the muzzle broadly rounded. Eye very small, not exceeding the external nostril. Rostril plate broad, low; internasals a little longer than wide. Frontal elongate, exceeding superciliaries by .33; occipitals large. Preocular large, triangular, the apex just touching the postnasal. Postoculars small, the upper larger, and in contact with occipital. Labials high and narrow, seven on the upper lip. Of these, the third is as wide as the base of the preocular, while the fourth and fifth, which support the orbit, are very narrow. The sixth is very large, and reaches the occipital on one side, but is separated on the other by a narrow temporal cut from its upper margin. Counting this one, the temporals are 1-1-1; the last two being large. Seventh labial but little longer than deep. The venom gland of this species must be large, as the head is much swollen laterally, and the labials exhibit a broad infolded margin at the borders of the lips which are in contact. The fangs are short. Inferior labials seven, all wide; geneials large, the pairs equal, separated by three scales from the first gastrostege. Fourth labial in contact with geneial in part, the other part with the fifth and sixth, bordered posteriorly by a plate which diverges from the geneials. Gastrostege 268; anal divided; urosteges 23.

Ground color crimson, crossed by numerous closely placed

as the *E. lemniscatus*. It is evident from the above description that it is distinct from the *E. mipartitus*, D. and B., with which Günther is disposed to unite it. See Am. Magaz. Nat. Hist., Sept. 1859. Prof. Jan's figure does not represent the species well, having the black rings too wide; it must have been taken from a young animal.

**COLOBOGNATHUS DOLICHOCEPHALUS**, Cope, sp. nov.

Scales in thirteen longitudinal series carinate to the urosteges on the tail, to the first row of scales on the posterior, and to the second row on the anterior part of the body. Head elongate, conic, scarcely distinct from the neck. Internasals very small, prefrontals very long. Frontal wide, openly angulate in front, with superciliary margins distinct from the parietal; latter plates well developed. Superior labials six, second bounding nasal and loreal; third a little, fourth largely in eye, fifth longer than high, in contact with parietal. One temporal above sixth labial, which is higher than long. Inferior labials six, second and third minute, fourth long and narrow. Postgeneials small, separated by a scutum. Oculars 0-1. Rostral elevated, not separating internasals. Tail slender, 5.75 times in the total length. Gastrosteges 131, anal 1, urosteges 39. Color of body above, and entire tail, black; a series of large distant red spots on each side, which often meet above, forming half-rings. These disappear on tail and neck. Below red, lower lip and chin black. Length, 12-14 inches.

San José, Costa Rica. Dr. Van Patten.

This species differs from the *C. hoffmannii*, Pet., in its more numerous labial shields, keeled scales, coloration, etc. From the *C. nasalis*, Cope (*Catostoma*, olim), in the fewer scale-rows (the latter has seventeen), the coloration, etc.

**COLOBOGNATHUS BRACHYCEPHALUS**, Cope. .

Scales in fifteen longitudinal rows, smooth, except a faint trace of carination near the posterior part of the body. Head flat; rather wide behind, and distinct from neck. Postgeneials small, separated by a scale. Rostral moderate, internasals not minute, prefrontals nearly broad as long. Frontal broad convex in front, superciliary and parietal sutures nearly continuous. Oculars 0-1. Superior labials six, two behind orbit, sixth longer than high, surmounted by one temporal; fifth longer than high, bounding

parietal; third and chiefly fourth in eye. Lower labials seven; geneials short, wide. Gastrosteges 124, anal 1, urosteges 38.

Color of body and entire tail black; gastrosteges reddish, brown margined. A yellowish or orange collar crosses behind the parietal plates, and a band of the same color extends from the side of the neck to the tail on the second and third rows in front, and third to fifth behind. This band is composed of two rows of alternating narrow spots, which are not always perfectly united.

Total length eight inches, the tail one-sixth of the total.

The species just described agree with the *C. nasalis*, the *C. hoffmannii*, and the *Catostoma semidoliatum*, in having the first labial behind the eye in contact with the parietal shield. They are intermediate, in the structure of the jaws, between the type of the genus and the last-named *Catostoma*. In the *C. semidoliatum* the maxillary bone is developed, and bears teeth opposite the first labial plate. In the *Colobognathus hoffmannii*, it, with the palatine, is cartilaginous in front, and bears no teeth anterior to the fourth labial shield. In the *C. brachycephalus* and *C. dolichocephalus*, the maxillary and palatine are a little better developed, the teeth extending to the posterior margin of the second superior labial. In the serpent described by me (Proc. Acad. Nat. Sci., 1868, p. 131) as *Catostoma nasale*, the dentition is precisely as in the two species here described, and I accordingly refer it to *Colobognathus*. This genus will then embrace four species. In the genus *Colophrys*, Cope (l. c., 1868, 130), the maxillary is still better developed, the teeth commencing at the anterior part of the

which the first and second are brightest. The second dark band is wider than the first and vertebral; it and the third are partly divided by a faint white line. Another white line on each side is produced by a series of dark spots on the ends of the gastrosteges. Labial plates black, yellow spotted. Head dark brown above, with a pale shade across frontal, and two just behind parietals. Chin and belly yellowish.

**ANOLIS INSIGNIS**, Cope, sp. nov.

Auricular opening half as large as eye. Scales intermediate; seven rows between orbits; one or two superorbital rows but little larger than the others; eight rows across middle of muzzle, and six across loreal region at middle. Three large and two small keeled infralabial rows. Scales of arm smooth, of tail striate.

Fawn-brown, with four double bands of greenish-blue between axilla and tail. Divided between the brown band by a yellow band, which widens below and breaks into spots above. A large round greenish-blue spot with brown centre in front of axilla.

Interorbital and occipital regions deeply concave, the latter bounded posteriorly by two elevated osseous ridges which meet behind at an acute angle. No facial rugæ, front flat except a slight median elevation. Muzzle with broad median ridge. Scales of front equal, those of canthus osseous. Postfrontal and zygomatic arches prominent, rugose. Inferior loreal rows of scales larger than others, nares surrounded by small scales. Fan very largely developed. An elevated crest or dermal fold on the nape. Scales of the sides and back (except some median rows) flat, pavement-like, equal, smooth, one-third the size of the smooth ventrals. Four median dorsal rows subconic, smaller than the ventrals. Tail proximally compressed, covered with equal scales. Limbs stout, the anterior extending four-fifths way to groin; the hinder reaching nearly to the ear. Scales of the limbs small; dilatations distinct.

The colors of this *Anolis* are very elegant. Besides the large spot behind the angle of the mandible, there is a blue one on the angle surrounded by fawn color, and this by yellow. Sides of the temporal region and neck with yellow spots. Bluish of first cross-band in a coarse netted figure. Top of head fawn color; fan entirely vermilion; belly bright yellow. Tail with broad blackish annuli; limbs with dark crossbars, three on tibia, femur, and forearm; two on humerus.

tends towards the occiput from the limbs of the nuchal V, inclosing a narrow brown area with it. Top of muzzle and limbs, blackish.

|                             | M.    |
|-----------------------------|-------|
| Total length . . . . .      | 0.108 |
| Length to orbit . . . . .   | .005  |
| "    " ear . . . . .        | .011  |
| "    " axilla . . . . .     | .018  |
| "    " groin . . . . .      | .0878 |
| Width head behind . . . . . | .006  |
| Length hind foot . . . . .  | .014  |

San José. Dr. Van Patten.

A small species of metallic colors, allied to the *A. viridiaeneus*, Peters. It is the eighty-fifth of the genus known to the writer.

III. The third collection was made by the U. S. Expedition to survey the Isthmus of Tehuantepec for a ship canal, under Capt. Shufeldt, by T. Hale Streets, M.D. It included a few species of fishes whose names are appended.

#### OPHIDIA.

*Elaps ornatus*, Jan. (with distant annuli).

*Masticophis margaritiferus*, Schl.

*Oxybelis acuminatus*, Wied.

*Coniophanes fissidens*, Gthr.

*Oxyrrhopus plumbeus*.

*Hydrops lubricus*, Cope, sp. nov.

#### LACERTILIA.

This species is darker than the last, and is much less ornamented. The color is a rich yellowish-brown; where the epidermis is lost on the head, a strong yellow pigment appears, so that it is probable that it could in life change to that color at will. A deep brown band commences by covering the whole eye and extends to the shoulder, where it is marked by pale centred ocelli. It is separated above by a narrow paler band from a large dark brown patch that covers the nape and scapular regions. Limbs and tail broadly and indistinctly brown cross-banded. Belly and throat immaculate.

San José, Costa Rica. Dr. Van Patten.

This large species is allied to the last, but perhaps resembles more the *Anolis biporcatus*, Wiegman, the largest *Anolis* of Mexico. The latter has, among other points of difference, keeled abdominal scales and a shorter muzzle, with very different coloration. The uniform size of all the scales is a noteworthy character of the *A. microtus*.

**ANOLIS TROCHILUS**, Cope, sp. nov.

Abdominal scales small, flat, smooth; tail cylindric, with similar scales. Dorsal scales smaller than ventral, pavement-like, very weakly keeled, graduating into those of the lower part of the side, which are smaller. Head moderately elongate; width between anterior margins of orbit, equal length of muzzle from same point, measured on the side. Interrugal concavity of the front well marked, occupied by very small scales, much less than those of the rugæ, in nine rows. Scales between rugæ and canthus, large. Two rows separate the superciliaries, which are separated by three or four rows from the occipital. Five rows of loreal scales. Six smooth scales in the supraorbital disc, those inner larger, transverse, the three outer longitudinal. Four rows of infralabials medially; nostril surrounded by small scales. Auricular meatus one-half eye-slit.

Limbs long, toes slender, the dilatations well marked. The fore limb oppressed, reaches the groin; the hind limb extended, attains the end of the muzzle. Fan little developed.

Above and below, brilliant metallic green with a few black dots along the vertebral line. Head and anterior part of sides, brown; a black V extending from the auricular openings, which are connected by a broad black band with the orbits. Another V ex-

equal. Interorbital region transversely convex, as wide as the diameter of the orbit. Dorsal fin originating a little behind that of the ventral.

General form elongate rhombic. Depth 2.5 times in length less caudal fin; length of head 4 times in same. Eye 3.2 times in head. Total length five inches. Color of superior half of head and body blackish; a vertical clavicular dark band, a leaden band from its upper margin to basis of caudal fin terminating in a pyriform black blotch of considerable size, which is prolonged on the caudal radii. Below, yellowish-white. Fins unicolor.

From the head-waters of the Coatzacoalcas River among the Cordilleras.

This species may be allied to those mentioned by Bocourt from the rivers of Belize and Peten (Ann. Sci. Nat., XI.); but it will be impossible ever to recognize them from the notes attached to the names.

IV. The collection made by Dr. Gabb was chiefly obtained near the city of San Domingo, in the southeastern part of the island. It embraces twenty species, as follows:—

### OPHIDIA.

*Dromicus parvifrons*, Cope.

*Hypsirhynchus ferox*, Gthr. (*H. scalaris*, Cope).

This is no doubt the true habitat of this snake.

*Thrasops catenbeyi*, D. B.

## BATRACHIA.

**Bufo gutturosus**, Latr. (Günther Cat. Anura B. M. Pl. V. fig. B.)

**Hyla vasta**, Cope, sp. nov.

**Trachycephalus marmoratus**, D. B.

**Lithodytes lineatus**, Grav.

**HYLA VASTA**, Cope, sp. nov.

The largest species of the genus, equalling in size the *Hypsiboas maximus*, *Cincloscopus granulatus*, etc.

Form stout and rather clumsy. Head broad; muzzle short, rounded; canthus rostralis well marked, concave; vertex strongly concave. Width of head at tympana .33 greater than length to line of the same. Eye not very large, tympanic disc one-fourth its area. Teeth in two rather long transverse arches opposite the posterior margin of the inner nares. Tongue broader than long; choanæ smaller than inner nares. Parietal fontanelle not large.

The limbs are stout, the forearm and tarsus bordered by a dermal fold behind, which has a scalloped thickened margin. No fringes on the body, but the skin is covered everywhere with small warts, which are indistinct or obsolete on the median upper surfaces of body and limbs. The under surfaces, except the tibia, are areolate-warty, nearly smooth on the pectoral region. The fingers and toes are webbed to the base of the last phalange of all but the longest or median toes. The dilations are immensely large, the largest being twice the size of the tympanum. The fore limb extended reaches a little beyond the groin; the hind limb measures the end of the muzzle with the heel. Some small dermal flaps on the ischia.

|  | M.    |
|--|-------|
| Length of head and body (5 inches) . . . . . | 0.126 |
| “ to line of tympana . . . . .               | .032  |
| “ of fore limb . . . . .                     | .076  |
| “ of hind limb . . . . .                     | .187  |
| “ of hind foot . . . . .                     | .081  |

Color above smoky gray, blackish on the head, with a brown band between the eyes. Inner surfaces dirty flesh-color, femur with three or four dusky cross-bands, unspotted behind. Throat black-spotted.

Near the city of Santo Domingo, W. I.

This tree-frog is probably not abundant, as it occurs now for

the first time in our collections, though I have examined four made in the island. From its size, its voice must be sufficient to betray its whereabouts to the naturalist. Its structural characters are apparently somewhat like those of *Hyla lichenosa*, Gthr., from Mexico. It differs in the larger palmation of the hand, concave front, minuteness of warts, size, coloration, etc.

**ANIVA VITTIPUNCTATA, Cope, sp. nov.**

Twelve series of abdominal plates; no heel spurs; one frontal plate. Seven plates in the infralabial series separated by granules and scales from the labials throughout; no plates inside the infralabials behind. A few gulars a little enlarged in the middle of the area. Edge of gular fold widely granular. Three supraorbitals, seven superciliaries. Teeth, 18 on maxillary bone, the anterior 14 with anterior denticle, the last 4 with both anterior and posterior. Brachial scales rather small, one row larger; postbrachials similar, two rows enlarged; antebrachials two narrow, one transverse row, well separated from brachials. Preeals, a marginal series with small central, with large ones bounding it, and three short rows of diamond-shaped scuta in front of them.

|                                 | M.    |
|---------------------------------|-------|
| Length (tail perfect) . . . . . | 0.278 |
| " to vent . . . . .             | .068  |
| " to auricular meatus . . . . . | .031  |
| " of fore limb . . . . .        | .08   |

Longest toe of extended hind limb reaches to orbit. Femoral

Museum said to be from "Anguilla Rock, near Trinidad." It appears, from Dr. Van Rijgersma's investigations, that the Island of Anguilla, far north of Trinidad, was meant.

*Anolis leachii*, Gray.

This species is near the last, but has coarser lateral scales and more slender mandible; it is also larger, and the color is quite different. It is bright green with a pale band over the shoulder, with a black spot above it, opposite the axilla. The fan is small.

**AMIVA ERYTHROPS**, Rijgersma, MS., sp. nov.

Abdominal plates in 12-14 series; no spurs on the heel. One frontal, four supraorbital, nine superciliary plates. Five infra-labials separated by a few intermedials from posterior labials, first not separated from third labial. Seven rows of larger gular scales extending entirely across the throat. Three larger series on gular fold, which has several rows of granules near margin. Brachials small, in four rows; postbrachials small. Antebrachials large, two rows hexagonal, one transverse. Femoral pores small, 36 in a series. Preanal scales two large median with a single row of one or two in front; small scales occur in some specimens behind the posterior two. Outer hind toe a little longer than inner.

Teeth in adults compressed, one or two only with denticulations. The end of the longest toe of the extended hind foot reaches the anterior margin of the ear.

Color brownish-olive, with a broad greenish band on each side the back from the nape above the ear. In young specimens these bands are bright. Another less distinct band extends along the side from above axilla to groin. Between these and the dorsals, and across the back, are transverse black reticulations. Belly greenish, the color appearing as spots on the outer scales. Thorax and edge of sides of fold black; throat bright yellow; sides of head red; upper surface brown; limbs olive, with black reticulation.

|                                       | M.   |
|---------------------------------------|------|
| Length of (tail reproduced) . . . . . | 0.32 |
| " to vent . . . . .                   | .126 |
| " to auricular meatus . . . . .       | .029 |
| " of fore limb . . . . .              | .05  |

VI. The collection from Ambyiacu R., from John Hauxwell, included the following:—

*Helicops carinicauda*, Wied.

*Liophis pygmaeus*, Cope.

*Amiva surinamensis*, Gray.

*Mabuia* ? *sepedii*, Gray, with only 28 series of scales on the body.

*Goniodaetylus humeralis*, Guich.

*Goniodaetylus varius*, Dum.

*Hyperanodon ochrocellaris*, Spix.

*Pedocnemis* sp. *pallus*.

*Ranula palmipes*, Spix.

*Atelopus spumarius*, Cope, sp. nov.

*Scytopsis allenii*, Cope.

*Scytopsis aurantiacus*, David.

*Hyla marmorata*, Daud.

*Hyla leucophyllata*, Beireis.

**ATELOPUS SPUMARIUS, Cope, sp. nov.**

Muzzle projecting, forming a narrow rim which is concave below, and overhangs the upper lip. Nostril lateral, above the symphysis of the mandible, when the mouth is closed. Loreal region plane, canthus rostralis straight, angular. Head, viewed from above, a section of a cone which is rounded truncate at the apex. Diameter of orbit equal from its front border to the nostril. Width of head behind equal length of humerus. Fingers nearly free, toes webbed at base. Tongue narrow, subcylindric. Muzzle marking basal third of forearm, and near middle of tarsus of hind limb.

Above, dark brown, with a broad band from orbit to groin, com-

gion. No species of *Dromicus* has been known in North America, and the occurrence of this one on the extreme eastern coast, and its very close affinity to a species (*D. callilæmus*, Gosse) common in Jamaica, are circumstances suggestive of origin by carriage in floating driftwood on the current of the Gulf Stream.

Habit moderately slender; tail 3.2 times in total length; head distinct, elongate, oval. Scales very thin, without scale-pores, in seventeen longitudinal series. Superior labials seven, third and fourth in orbit; fifth higher than long, with sixth separated by a narrow temporal from occipital; seventh longer than high. Inferior labials nine, four bounding geneials. Postgeneials longer than pregeneials. Internasals nearly quadrate; prefrontals longer than wide. Frontal, anterior width .75 length; parietals rather elongate. Nostril in prenasal, which is lower than postnasal; loreal very small, high as long; sculars 1-2. Gastrosteges 126; urosteges 77.

In *D. callilæmus* the frontal plate is very nearly as wide as long, and the gastrosteges number 140; the coloration is also different.

Color above, a rich golden brown, the scales of the two inferior rows on each side broadly gold-edged, the color of the back commencing on the third row. The ends of the scales of the vertebral row are sometimes darker-tipped. Head dark brown, darkest behind, with numerous but obscure paler vermiculations. Sides of head paler, with a reddish-brown band from the rostral plate through the eye to the middle of the last labial. Labials whitish, with black dots on the posterior, in oblique rows. Below white, lower labials sparsely black-dotted. A pair of pale dots on the common occipital suture.

This, the first addition to the Ophidia of our Eastern States made for some years, was discovered by Dr. Henry C. Yarrow, near Fort Macon, on the coast of North Carolina. Near the same time another new Ophidian came to hand, as follows:—

**CONTIA PYGÆA**, Cope, sp. nov.

In its generic features, this species may be thus described. The dentition is complete, and the teeth of the maxillary bone are of equal length. The scales are smooth and without pores, and the anal plate is divided. The head-shields are normal; the nasal, usually entire in the genus, is in this species half divided by a

suture from the nostril to the labial border. Two pairs of genials; a loreal; rostral obtuse. The head is little distinct from the body, and the pupil is round.

The form of this species is stout and subcylindric, the tail entering the total length 4.33 times. The head is stout, oval, the profile a little arched. The centre of the orbit, anterior to the middle of the lip margin. The rostral is visible from above; the nasals approach so as to reduce the internasals to a subtriangular form each, of which the middle and posterior suture are equal. The frontal is long, and with parallel sides, its length exceeding that of the head in front of it. The parietals are still longer, and wide, with subtruncate outline behind. Loreal plate higher than long, half the height of the single preocular, which does not reach the frontal. Postoculars 2; temporals 1-2, the first in contact with three labials. Superior labials eight, their height subequal, the fourth and fifth bounding the orbit. Inferior labials nine, six in contact with genials, five with the first, two with the second genial. Latter subequal. Scales in seventeen series, those of first deeper than long. Those of sides at vent and of basal two-thirds of the tail roof-shaped or obtusely keeled. About one-sixth of the length in front of and behind the vent compressed, the dorsal outline keel-formed. Gastrosteges 120; urosteges 54.

Coloration above, black, with a very faint pale line along the centre of each scale of several lateral series. The lines are more distinct near the vent and on the tail, and heighten the effect of carinae produced by the angulation of the scales. Beneath, pale in the alcoholic specimen, the posterior half of the body, with the

## DESCRIPTIONS OF FIVE NEW SPECIES OF CRUSTACEA FROM MEXICO.

BY T. HALE STREETS.

**PACHYCHELES MEXICANUS**, nov. sp.

Plate II. Fig. 1.

Carapax broadly oval, about as broad as long, slightly convex antero-posteriorly; surface shining, but minutely granular through the lens; anterior portion of the carapax deflexed, triangular, and furrowed, a small white spot at the tip; neither spines nor teeth anywhere on the body; eyes small, supra-orbital border concave and inflated. Carpus as broad as long; three teeth on the anterior border; two slightly elevated ridges of granules on the superior surface; hand broad and large, the right larger than the left; fingers hooked at their extremities, denticulated; surface of the carpus and hand more coarsely granulated than the carapax; the granules extend to the ends of the fingers. Color red, with patches of a lighter shade; three posterior pairs of legs striped; the last article furnished with a few stiff hairs. Length of the carapax 0.18 inch; the hand 0.25 inch.

*Habitat.*—Gulf of Tehuantepec, Mexico.

**PANULIRUS GRACILIS**, nov. sp.

Plate II. Fig. 2.

Antennary ring armed with two spines, situated near together on the anterior border; behind these, and separated more widely from each other, are two rudimentary spines, seen through the lens; two stout horns projecting forward over the base of the ophthalmic peduncles; surface of the carapax covered with spines, larger anteriorly than posteriorly; also furnished with a few stiff hairs, attached mostly to the spines; epistoma armed with three spines; abdomen smooth; the transverse sulci, except the last, interrupted in the middle; a pit between the last nearly connects them, separated by two very narrow bands on either side of the pit. Color reddish-brown; external antennæ striped with bands of white. Length 0.9 inch.

*Habitat.*—Gulf of Tehuantepec, Mexico.

**PALEMOM DASYDACTYLUS**, nov. sp.

Plate II. Fig. 3-3a.

Rostrum long and slender, reflexed, extends beyond the lamelliform appendages of the external antennæ; armed on the superior margin with nine or ten teeth, and six or seven on the inferior

1871.]

margin; the first tooth on the upper margin small, situated more directly on the carapax than, and separated from, the following six, which are situated together; the seventh and eighth separated by a wider space; last tooth quite small; apex of the rostrum pointed; the fifth tooth on the upper margin (counting from the carapax) nearly over the first on the lower margin; eighth over the last on the lower margin; those with but six teeth on the inferior margin have the last under the seventh of the superior margin; the first constant in its situation. Two external flagella of the internal antennæ united for a very short distance, smaller flagellum very short; all the others very long. First pair of legs short and slender; carpus more than twice the length of the hand; fingers half the length of the hand, slightly pubescent; second pair of legs very long; carpus not quite as long as the hand; fingers cylindrical and straight along their approximated surfaces, not as long as the palmar portion of the hand, densely downy; under surface of this pair of legs covered with spinules to the base of the fingers; the spinules on the carpus arranged in four parallel rows, of which the anterior and posterior rows contain the largest spinules. Posterior legs rough to the feel, pubescent.

This species can very readily be distinguished from *P. mexicanus* (Saussure), which it most closely resembles, by having six or seven teeth on the inferior margin of the rostrum. The carpus in *P. mexicanus* is longer than the hand, and the terminal segment of the abdomen is armed with three spines. In *P. dasydactylus* the terminal segment of the abdomen is armed with five spines—

between the eighth and ninth on the upper margin; those with but nine teeth on the superior margin have the first below under the space between the fourth and fifth; the last midway under the space between the seventh and eighth of the superior margin. Inner free flagella of a deep red color. Anterior pair of legs slender and delicate; carpus more than twice the length of the hand; hand slightly pubescent; second pair of legs slender, smooth on the upper surface; under surface beset with very minute spiniform granules, seen only through the lens; carpus longer than the hand, twice the length of the palmar portion of the hand; fingers cylindrical, straight, less than half the length of the hand; posterior legs smooth. Length 2.81 inches.

This species is very closely allied to *P. mexicanus* (Saussure), and may prove to be nothing more than a variety of that species. The measurements of the second pair of legs of *P. sexdentatus* agree with De Saussure's description, but differ widely from the measurements of his figure. *P. mexicanus* has but four or five teeth on the inferior margin of the rostrum. The terminal segment of the abdomen in *P. sexdentatus* is armed with three small teeth, and two longer movable spines situated one on either side of the middle tooth; the hand is very largely beset with hairs.

*Habitat*.—Same as the preceding.

**PALEMÓN FLUVIALIS**, nov. sp.

Plate II. Fig. 5–5a.

Rostrum short, lanceolate, somewhat arched above; not as long as the lamelliform appendages of the external antennæ, reaching to the end of the second joint of the antennæ; superior margin armed with seven teeth, the inferior margin with two, situated near the point of the rostrum. One specimen of this species had but four teeth above and one below. Two flagella of the internal antennæ united for a very short distance; spines on the lateral portion of the carapax very small; first pair of legs slender; hand more than half the length of the carpus; hand of the second pair stout; carpus shorter than the palmar portion of the hand, gradually enlarged toward the hand; fingers cylindrical and straight, shorter than half of the hand, the same length as the carpus, beset with a few stiff hairs; legs smooth. Length 1.3 inches.

This is a fresh-water PALEMÓN, taken from a tributary of the Coatzacoalcos River among the Cordilleras.

1871.]

AUGUST 8.

Dr. CARSON, Vice-President, in the chair.

Fifteen members present.

*Remarks on Fossil Vertebrates from Wyoming.*—Prof. LEIDY remarked that the collections of fossils presented this evening, by Drs. J. Van A. Carter and Joseph K. Corson, were of unusual interest. They consist of remains mainly of turtles, with those of mammals and crocodiles, and were obtained from the tertiary deposits in the vicinity of Fort Bridger, Wyoming Territory.

The great abundance of remains of turtles, of many species and genera, of fresh-water and terrestrial habit, obtained in Wyoming, indicates this region to have swarmed with these animals during the earlier portion of the tertiary period. Crocodiles and lacer-tian reptiles were likewise numerous. The many mammalian remains found in association with the reptilian fossils mainly belong to tapiroid and carnivorous animals.

The Wyoming tertiary fauna presents a remarkable contrast with the later faunæ of the Mauvaises Terres of White River, Dakota, and of the Niobrara River, Nebraska. Among the large number of fossils from these two localities, rich in evidence of mammalian life, there occur the remains of a single species of turtle in each, and none of crocodiles or other reptiles.

Dr. Carter's collection, besides containing remains of *Trionyx guttatus*, *Emys Jeanesianus*, *E. Haydeni*, and *E. Stevensonianus*, and *Baena arenosa*, also adds two new turtles to the list. One of these is a species of *Emys* of the largest size, and exceeds any now living. The carapace has measured about two feet and a half in length, and the sternum about two feet. In honor of its

and the sea-turtles, they are covered with large scutes, four in number, as in *Baena arenosa*. The intermediate vertebral scutes, are longer than broad—the third being 4 inches long, and  $3\frac{1}{2}$  inches wide. A peculiarity of the species is the undulating manner in which the costal scutes join the marginal scutes, and the sternal scutes one another. The species may be named *Baena undata*.

Dr. Carter's collection also contains some fragments of bones of a large mammal, which are so mutilated as to be hardly characteristic. A jaw fragment among them, with the retained fragments of the true molars, would appear to indicate a species of *Palæosyops* much larger than *P. paludosus*. In absence of other evidence, it might be viewed as a species of this genus, under the name of *P. major*. The true molars occupied a space of four and a half inches. The last molar measured an inch and seven-eighths fore and aft, and an inch transversely in front.

Dr. Carter had also sent some fossils to Prof. Leidy, among which were portions of jaws, with nearly full series of teeth of *Hyrachyus agrarius*. This animal is related to the Tapir, *Hyracodon*, and *Lophiodon*. The formula of its dentition is the same as in *Hyracodon*: 7 molars, 1 canine, and 3 incisors. The true molars are like those of *Lophiodon*, except that the last lower one has a bi-lobed instead of a triple-lobed crown. Apparently the same animal has been indicated by Prof. Marsh, under the name of *Lophiodon Bairdianus*. A fragment of a lower jaw containing the last premolar, and the first true molar, indicates a larger species of *Hyrachyus*, which may be named *H. eximius*. The crown of the last premolar is  $7\frac{1}{4}$  lines antero-posteriorly, and  $5\frac{1}{2}$  transversely. The true molar has measured about  $8\frac{1}{2}$  lines fore and aft, and 6 lines transversely. The depth of the jaw fragment below the true molar is over an inch and a half.

Another fossil is a mutilated incisor, indicating a species of *Trogosus* rather more than half the size of *T. castoridens*, which may be named *T. vetulus*.

A femur of *Palæosyops paludosus*, in the collection, exhibits the third trochanter, characteristic of the unequal-toed pachyderms. The astragalus of this animal almost repeats that of the living Tapirs.

Among the remains of Dr. Corson's collection, there is the greater part of the lower jaw of a large crocodile, but too much broken to attempt to give an opinion in regard to its specific character, until it is in some degree mended or restored.

AUGUST 15.

The President, Dr. RUSCHENBERGER, in the chair.

Eight members present.

---

AUGUST 22.

The President, Dr. RUSCHENBERGER, in the chair.

Nine members present.

---

AUGUST 29.


The President, Dr. RUSCHENBERGER, in the chair.

Fourteen members present.

*Notice of some Extinct Rodents.*—Prof. LEIDY remarked that Dr. J. Van A. Carter had recently sent to him some remains of rodents discovered in the tertiary deposits near Fort Bridger, Wyoming. Prof. Marsh has already indicated some remains of the same order, obtained from the same locality, which he has referred to a genus under the name of *Sciuravus*. The characters given are insufficient to determine positively whether the remains I have the opportunity of examining pertain to the same genus, though, from the greater size of the animals they indicate, they clearly belong to different species.

The remains appear to have belonged to a peculiar genus of the *Sciurine* family apparently allied to *Arctomys*.

The lower jaw is short and deep compared with that of most living rodents, apparently from a shortening of the bone in advance of the position of the molars. To compensate for this



in the sciurine animals. The crown is composed of four lobes, of which the antero-internal is the largest and most prominent, the one behind it is the smallest, and the outer ones are of intermediate size, and nearly equal.

If not *Sciuravus*, the genus may be named *PARAMYS*. The specimens probably indicate three different species of the genus, mainly differing in size.

*PARAMYS DELICATUS*.—The largest species was perhaps a fourth less in size than the Maryland marmot, though its molar series is equal in length with that of the latter, measuring three-fourths of an inch. The hiatus in advance of the molars has measured about three lines and a half, or about half that in the Maryland marmot. The depth of the jaw at the first molar is  $6\frac{1}{2}$  lines, at the penultimate molar 6 lines. The incisor is  $2\frac{1}{2}$  lines fore and aft, and  $1\frac{1}{2}$  lines transversely.

The specimen upon which the species is indicated consists of the greater portion of the right ramus of the lower jaw. It presents two mental foramina, one below the first molar, besides that in the usual position. A prominent tubercle is formed at the angle of convergence of the two ridges bounding the fore part of the masseteric fossa.

*PARAMYS DELICATISSIMUS*.—The smallest species is indicated by a similar specimen to the former, and was about two-thirds the size of the largest species. The molar series is half an inch in length. The hiatus in advance of the molars measures  $2\frac{3}{4}$  lines. The depth of the jaw at the first molar is  $4\frac{1}{2}$  lines, at the penultimate molar 4 lines. The incisor is  $1\frac{1}{2}$  lines fore and aft, and 1 line transversely.

*PARAMYS DELICATIOR*.—An intermediate species is apparently indicated by the greater portion of a left ramus of the lower jaw. The molar series has measured about  $7\frac{1}{4}$  lines in length. The jaw is 5 lines deep at the penultimate molar. The incisor is 2 lines fore and aft, and  $1\frac{1}{2}$  lines transversely.

A smaller rodent than the preceding, and of a different genus, is indicated by the portion of a lower jaw containing the posterior two molars, and the fangs of the two in advance.

The constitution of the jaw is similar to that in the former genus. The jaw being comparatively short and deep; the hiatus in advance of the molars short and nearly straight, and the masseteric fossa advancing only as far as the position of the penultimate molar. The molars are inserted each by two fangs; their crowns are slightly greater fore and aft, especially the first and last of the series.

The crown of the penultimate molar in its worn condition presents a pair of transverse elliptical dentinal tracts united by a narrow median fore-and-aft isthmus. In the slight recess of the inner poles of the ellipses of dentine, a small tubercle projects with a circular islet of dentine on the summit. The crown of the  
1871.]

last molar exhibits five shallow tubercles with minute dentinal islets at the summits.

The size of the animal was but little greater than the domestic mouse. The molar series measures 3 lines in length. From the front of the incisor to the back of the last molar measures  $4\frac{1}{2}$  lines. The relations of this extinct rodent I have not determined, nor can I refer it to any genus with which I am familiar. It may be named *Myrops minimus*.

On favorable report of the committee, the following paper was ordered to be published:—

DESCRIPTIONS OF NEW SPECIES OF BIRDS OF THE FAMILIES  
TROGLODYTIDÆ AND TYRANNIDÆ.

BY GEO. N. LAWRENCE.

## TROGLODYTIDÆ.

1. *Catherpes sumichrasti*.

Upper plumage and wing coverts of a deep reddish-brown, sides of the head lighter, and the rump more of a blackish-brown; quills dark brownish-black, the secondaries narrowly edged with the same color as the back, and crossed with darker, nearly obsolete bars; throat of a dull light grayish-rufous, breast and sides of the neck of a clear rather dark rufous, each feather of the lower neck and breast crossed with several faint dusky narrow bars; the abdomen is dark reddish-brown, besprinkled with small round white spots, which are surrounded narrowly with black, the sides of the breast and abdomen are of a dark reddish-brown, crossed with not very conspicuous black bars; the sides under the wings, thighs, and under tail coverts deep blackish-brown like the rump; upper mandible black, the under is yellow, except at the end and on the sides for its terminal half, where it is blackish-brown; "iris brown;" tarsi and toes black; the tail, unfortunately, is deficient.

Length to rump, 5 inches; wing,  $2\frac{3}{4}$ ; bill,  $1\frac{1}{8}$ ; tarsi,  $1\frac{1}{8}$ ; hind toe and claw,  $\frac{7}{8}$ .

*Habitat.* "Mata Bejuco (Vera Cruz)."

"Collected by Mr. T. Labarraque."

Type in Museum Smithsonian Institution, from the collection of Prof. F. Sumichrast.

*Remarks.*—This is rather a remarkable looking bird, and seems to be a second species of *Catherpes*, though of a much stouter form and darker colors than *C. mexicanus*; the bill is precisely of the same form, though proportionally stronger, and the minute white spots on the abdomen are similar to those on the back of that species; the wings are very short and rounded, and the feet large and strong.

It was received over two years since, and I delayed its description hoping to get others, that by the character of the tail its 1871.]

true position might be more satisfactorily determined. Prof. Sumichrast has not been able to obtain any more specimens, and, as he has informed me his collections are suspended for the present on account of the revolution which has taken place in Tehuantepec, I have concluded to describe it, and have conferred his name upon it.

### TYRANNIDÆ.

#### 2. *Myiozetetes grandis*.

Crown dusky olive-gray, with a concealed crest of bright vermillion; front and sides of the crown pale yellowish-white, the stripe becoming broader as it extends backwards; lores and sides of the head dark grayish fuliginous; upper plumage greenish-olive; tail feathers dark brown, narrowly margined with the color of the back; quills dark brown, narrowly edged with greenish-yellow; the smaller wing coverts are the color of the back, the middle and larger coverts dark brown, tipped with dull pale yellow; throat grayish-white, just tinged with yellow; entire under parts besides, and under wing coverts gamboge yellow; bill and feet black.

Length,  $7\frac{3}{4}$  inches; wing,  $3\frac{3}{4}$ ; tail,  $3\frac{5}{8}$ ; tarsi,  $\frac{3}{4}$ .

*Habitat.* "Province of Tumbes, Peru."

The type is in the Museum of Vassar College, and was received by Prof. Orton from J. F. Reeve, Esq.

*Remarks.*—This species somewhat exceeds all others of the genus in size, and is also of a deeper yellow below; in its color-

cept the primaries, conspicuously margined with dull white; throat grayish-white; lower part of neck in front and upper part of breast light cinereous; breast, abdomen, under tail coverts, and under wing coverts pale yellow; inner margins of quills grayish-white; entire bill black; tarsi and toes brownish-black.

Length (skin),  $5\frac{1}{2}$  inches; wing,  $2\frac{7}{8}$ ; tail,  $2\frac{7}{8}$ ; bill,  $\frac{7}{8}$ ; tarsi,  $\frac{1}{8}$ .

*Habitat.* Venezuela? Collected by Mr. C. Wood.

Type in my collection.

*Remarks.*—The nearest ally of this species seems to be *E. traillii*, but the plumage above is browner, with scarcely a tinge of olive-green; the margins of the wing coverts and quills are whiter, besides, the gray front and superciliary stripe do not exist in *E. traillii*; in the new species the yellow of the abdomen is much brighter, but the smaller jet black bill is the most striking characteristic difference.

#### 4. *Myiarchus yucatanensis*.

*Myiarchus mexicanus*. Lawr. Ann. Lyc. N. Y., vol. IX., p. 202.

Soon after suggesting that this bird might be *Tyrannula mexicana*, Kaup, on account of its short wings, and contending for the integrity of my *M. cinerascens* (generally referred to *mexicanus*) on account of its longer wings, I found from an examination of many examples of *cinerascens* that the measurement of the wings was not a reliable character in this genus. This caused me to question the probability of the *Yucatan* bird being Kaup's *mexicanus*, and I concluded the true status of that species could only be determined by an inspection of the type. Consequently I solicited the aid of Mr. Sclater, sending him my specimen of the *Yucatan* bird, and about the same time Prof. Baird sent the Smithsonian specimen, with the request that he would endeavor to get a view of Dr. Kaup's type. He recently wrote Prof. Baird that on application to Dr. Kaup, he sent the type of his *T. mexicana* for examination, which, to his surprise, proved to be *M. cooperi*, Baird.

The species now described, therefore, required to be named.

Its length is  $7\frac{1}{4}$  inches; wing,  $3\frac{3}{8}$ ; tail,  $3\frac{1}{2}$ ; tarsi,  $\frac{7}{8}$ .

It is allied to *M. cinerascens*, *mexicanus*, and *lawrencii*, but is smaller than the first two, and rather larger than the last; the bill is not so depressed as in *lawrencii*, the culmen being more rounded. It differs from all the above-named species in being  
1871.]

brown above, and in the color of the abdomen and under tail coverts being of a pale dull ochreous, whereas in the others these parts are clear yellow; the red color on the inner tail feathers occupies the outer portion of the inner webs for half their width, this color blends with the dark color next the shaft, the separation of the colors is not so clearly marked as in *mexicanus*. The extent of the red color on the tail feathers is a good character on which to separate the allied species, in *M. cinerascens* this color occupies the entire web up to the shaft; in *mexicanus* it takes up about four-fifths, leaving a well-defined dark line next the shaft; in *yucatanensis* it extends over half of the inner web; but in *lawrencii* it exists only as a mere bordering, and in many specimens it is very faint.

SEPTEMBER 5.

The President, Dr. RUSCHENBERGER, in the chair.  
Ten members present.

---

SEPTEMBER 12.

The President, Dr. RUSCHENBERGER, in the chair.  
Eighteen members present.

The following paper was presented for publication : " Catalogue of Crustacea from the Isthmus of Panama, collected by J. A. McNeil." By T. Hale Streets.

---

SEPTEMBER 19.

The President, Dr. RUSCHENBERGER, in the chair.  
Nineteen members present.

---

SEPTEMBER 26.

The President, Dr. RUSCHENBERGER, in the chair.  
Eleven members present.

The death of Dr. John Edward Holbrook was announced.  
On favorable report of the committee the following paper was ordered to be published:—

CATALOGUE OF CRUSTACEA FROM THE ISTHMUS OF PANAMA.  
COLLECTED BY J. A. McNEIL.

BY T. HALE STREETS.

BRACHYURA.

MAIOIDEA.

FAMILY MAIIDEA.

Subfamily PISINAE.

*Omalacantha*, nov. gen.

Carapax pyriform as in *Pisa*. Orbit complete above and below, oval, superior border armed with a triangular tooth. Eye very small; peduncle short. Rostrum well developed, bifurcated nearly to base, horns divergent, apices convergent; præorbital tooth flattened, obtuse; external antennæ not hidden by rostrum, but completely exposed, on same level as rostrum; first and second articles broad, flattened, clubbed at distal extremity.

This genus is very closely allied to that little known genus, *Microphrys*,<sup>1</sup> M. Edw. It is readily distinguished from *Microphrys* by its greater triangular form (not being broader than long); by the broad, club-shaped articles of external antennæ (in *Microphrys* they are cylindrical), and by the antero-lateral border of carapax being less inflated.

*Omalacantha hirsuta*, nov. sp.

Carapax triangular, convex, tuberculated, pilose; hairs hooked

of branchial region. Tooth on superior margin of orbit obtuse; orbit obtuse at external angle. External antennæ ciliated; rostrum slightly reflexed, more so in female than in male. The chelipeds larger in male than in female, smooth, with exception of arm, which presents a row of tubercles on upper surface; covered with rounded spots of a violet-red color. Fingers closely approximated and finely denticulated at extremity; in female approximated along their whole length. Two or three rudimentary tubercles on third article of second pair of feet. A deep red spot at the projecting lateral angle of carapax. Color reddish shade. Length, 1.37 inch; breadth, .94 inch.

Subfamily MITHRACINÆ.

**Mithraculus coronatus**, Stimpson. An. Lyc. Nat. Hist. N. Y., vol. VII., p. 186.

**CANCROIDEA.**

FAMILY CANCRIDÆ.

Subfamily XANTHINÆ.

**Carpilius corallinus**, M. Edw. Hist. Nat. des Crust., tom. I., p. 381.

**Actæa labyrinthica**, Stimpson, An. Lyc. Nat. Hist. N. Y., vol. VII., p. 204.

**Menippe mercenaria**, Stimpson. **Cancer mercenaria**, Say. Journ. Acad. Nat. Sci. Phila., vol. I., p. 448.

**Panopeus chilensis**, Edw. et Lucas. D'Orbigny's Voy. en Am. Mérid., Crust., p. 16; pl. VIII., fig. 1.

FAMILY ERIPHIIDÆ.

Subfamily ERIPHINÆ.

**Eriphia gonagra**, M. Edw. Hist. Nat. des Crust., tom. I., p. 426, pl. XVI., figs. 16 and 17. Dana. U. S. Expl. Exped., Crust., vol. I., p. 250.

FAMILY PORTUNIDÆ.

Subfamily LUPINÆ.

**Lapa diantha**, M. Edw. Hist. Nat. des Crust., tom. I., p. 451. Dana, U.S. Expl. Exped., Crust., vol. I., p. 272, pl. XVI., fig. 7.

**Lapa rubra**, M. Edw. Hist. Nat. des Crust., tom. I., p. 454.

## OCYPODOIDEA.

## FAMILY MACROPHTHALMIDÆ.

## Subfamily OCYPODINÆ.

*Ocypoda Gaudichaudii*, Edw. et Lucas. D'Orbigny's Voy. en Am. Mérid., Crust., p. 26, pl. XI., fig. 4.

*Ocypoda rhombæa*, M. Edw. Hist. Nat. des Crust., tom. II., p. 46.

## FAMILY GRAPSIDÆ.

## Subfamily GRAPSINÆ.

*Grapsus pictus*, Latr.; M. Edw. Hist. Nat. des Crust., tom. II., p. 66.

## FAMILY GACARCINIDÆ.

## Subfamily UCAINÆ.

*Uca lavis*, M. Edw. Hist. Nat. des Crust., tom. II., p. 22.

## ANOMOURA.

## FAMILY HIPPIDÆ.

*Hippe emerita*, Fabr.; M. Edw. Hist. Nat. des Crust., tom. II., p. 209.

## FAMILY PORCELLANIDÆ.

*Petrolisthes armatus*, Stimpson. An. Lye. Nat. Hist. N. Y., vol. II., p. 73. *Porcellana armata*, Gibbs, Proc. Am. Assoc., 1850, p. 176.

*Petrolisthes occidentalis*, Stimpson. An. Lye. Nat. Hist. N. Y., vol. VII., p. 73.

## FAMILY PAGURIDÆ.

Subfamily PAGURINÆ.

## FAMILY CENOBITIDÆ.

**Cenobita diogenes**, Latr. M. Edw. Hist. Nat. des Crust., tom. II., p. 240, pl. XXII., figs. 11 and 13.

**Cenobita intermedia**, nov. sp.

Anterior portion of carapax convex, narrowed in front, granulated. Differs from *C. purpurea*, Stm., in not being more granulated posteriorly than anteriorly, nor are the granules acute and setous. Lateral portion pilous; margin of branchial region projecting, prominent. Eyes compressed, triangular, acute; peduncles nearly as high as long, finely granulated on superior surface.

Tibia of the third pair of legs, left side, produced at inferior border; ultimate and penultimate articles convex externally, smooth and punctate as in *C. purpurea*; tarsus irregularly quadrilateral, longer than right; inferior surface concave; fine, close-set row of black-tipped spinules on inferior surface of tarsi of second and third legs, left side. Legs spinulose (with exception mentioned), hairy; tarsi triangular, concave on inferior surface. External surface of larger hand sparsely granulated; granules of a pearly appearance. Coxæ of fifth pair produced in male. Length of carapax .94 inch.

**Cenobita panamensis**, nov. sp.

Carapax as in *C. intermedia*. Eyes also similar. Tibia of third leg, left side, slightly produced at inferior angle; penultimate article convex externally and granulated, in this respect differing from *C. purpurea* and *C. intermedia*; tarsus irregularly quadrilateral, shorter than right, thereby differing from *C. perlata* and *C. intermedia*; row of spinules on supero-lateral margin; row on superior surface; spinules sparsely on external surface; denticulated ridge on inferior surface of tarsi of second and third pairs; spinules black-tipped; inferior surface not so much evacuated as in *C. intermedia*, triangular. Larger hand granulated; granules acute, except on external surface, black-tipped. Coxæ of fifth pair produced in male.

Length of carapax 1.62 inch.

**MACROURA.****FAMILY GEBIDÆ.***Gebia longipollex*, nov. sp.

Front tridentate; middle tooth largest, and presents at its extremity two small obtuse teeth, which give to it a bifid appearance when looked at from above; furrowed in the median line, small spine on antero-lateral margin of carapax just over the external antennæ; anterior portion of carapax rough and hirsute; scabrous surface reaching about half way to the dorsal suture. Hands equal, smooth, without spines or teeth, marked with longitudinal rows of hair; row on inferior margin very long; thumb long, reaching almost to extremity of finger, slightly incurved; movable finger very pilose, with two teeth on inferior margin—one near base, and one near apex; latter receives point of thumb, two very small teeth situated together near base of thumb; spine on upper and lower apex of carpus, and two small ones on antero-lateral margin; spine on distal extremity of arm. Second pair of legs ciliate above and below at extremity; tarsus smooth, third article ciliate below, and armed with spine above at distal extremity; remaining pairs unarmed. Caudal segment rectangular.

Length, 1.12 inch.

**FAMILY PALINURIDÆ.**

*Panulirus guttatus*, Gray *Palinurus guttatus*, Latr. Ann. du Mus., tom. III., p. 323. M. Edw. Hist. Nat. des Crust., tom. II., p. 297, pl. XXII., fig. 1.

*Panulirus americanus*. *Palinurus americanus*. Lamarck. M. Edw. Hist. Nat. des Crust., tom. II., p. 298.

**FAMILY PALÆMONIDÆ.****Subfamily ALPHEINÆ.***Alpheus hispidus*, nov. sp.

Carapax compressed; rostrum short, acute; surface between the eyes carinated; anterior border of eye-shields rounded, and without spines. Lamelliform appendages of external antennæ not quite as long as base, little longer than base of internal antennæ. Second article of internal antennæ twice as long as first and third; basal tooth of inner antennæ not longer than first article; basal spine of outer antennæ short, and hooked inward. Hands of first pair of feet unequal; margins of larger hand indented near the

[December 5,

fingers; lower indentation deep; surfaces sulcated, uneven; margins of the fingers beset with long hairs; movable finger considerably hooked at extremity; smaller hand cylindrical and regular; fingers longer than palmar portion of the hand; inner edges of approximated borders pubescent; no spines on arm. Feet of second pair but little longer than third; first joint of carpus as long as second and third, and little longer than third, fourth, and fifth; fifth not as long as third and fourth, and shorter than hand; third article of following pairs of legs devoid of spine at inferior apex.

Length, 1.5 inch.

#### FAMILY PENÆIDÆ.

*Panmus occidentalis*, nov. sp.

Rostrum longer than the lamelliform appendages of the outer antennæ, recurved, pointed at extremity. In the examination of a number of specimens the majority presented ten teeth on the superior margin of the rostrum, and four on the inferior; may vary from eight to eleven on the upper, and from four to five on the lower border. Carapax carinated almost to posterior edge; sulcus on each side of rostrum terminating about midway the carapax; spine situated on lateral portion near anterior border, opposite the insertion of superior antennæ; ridge running from this spine obliquely downward and backward; second spine behind, and on a lower level than the first, and separated from it by a sulcus; two smaller sulci forming two sides of a triangle around base of second spine. Eye large and rounded; sulcus on external border of peduncle. Flagella of superior antennæ usually shorter than antennary peduncle (in one large specimen they were longer). Bases of two first pairs of legs armed with three spines—two on first pair, and one on second; terminal segment of abdomen sulcated, pointed, devoid of lateral spines; penultimate and antepenultimate segments carinated—the ridge commencing on the segment before the antepenultimate, and terminating at the end of penultimate in an acute spine. Length of large specimen five inches.

The greatest affinities of this species are with *P. indicus*, Edw.



OCTOBER 3, 1871.

The President, Dr. RUSCHENBERGER, in the chair.

Eighteen members present.

Mr. THOMAS MEEHAN referred to some observations made by him last spring before the Academy in regard to the office of bud scales and involucral bracts. The general impression was that they were formed for the purpose of protecting the tender parts beneath. At that time he exhibited branches of *Fraxinus excelsior* on which some of the buds were entirely naked, and others clothed with scales in the usual manner. They could scarcely be for protection in this instance, as both were equally hardy.

He now had to exhibit an ear of corn which had been produced without the usual involucral bracts or husks, and yet was as perfect as if clothed in the usual way, showing that the husk was of not much importance as a protecting agent. An interesting point was that this ear had been formed on the end of a male panicle or tassel. It was not uncommon to find scattered grains of corn amongst male flowers, but a perfect ear like this he had never before seen. The ear was eight-rowed, and contained two hundred perfect grains. It was the variety known as "popcorn."

Dr. HOWELL announced the death of Mr. Chas. Wilson Peale.

---

OCTOBER 10.

The President, Dr. RUSCHENBERGER, in the chair.

Eighteen members present.

*Remarks on the Minerals of Mount Mica.*—PROF. LEIDY remarked that the specimens of minerals presented this evening by Mr. Bement and himself were part of a collection which they had obtained at Mt. Mica, near Paris, Oxford Co., Maine. At the invitation of, and in company with, Dr. A. C. Hamlin, of Bangor, they had recently made a visit to that locality, celebrated for its beautiful tourmalines and other interesting minerals.

The position in which these occur is a ledge of coarse albitic granite upon the brow of a hill known as Mt. Mica. The granite has been quarried in the search of mineral specimens to the extent of about forty square yards, and, thus exposed, appears mainly composed of a tough, white, amorphous feldspar, without distinct cleavage, and with quartz sparingly disseminated. The white feldspar is mottled with black tourmalines, varying in size from an inch to a foot in length. These are brittle, and so firmly fixed in position as rarely to be isolated in an entire condition. In many positions the quartz and feldspar occur more intimately intermingled in the condition of graphic granite.

1872.]

PART III.—17

Most parts of the rock are devoid of mica, but in some positions an abundance of large crystals of muscovite are mingled with the other constituents. The muscovite, of a smoky color, often contains compressed crystals of tourmaline, mostly olive-green and translucent, simple or compound, and more or less radiant.

Apparently occupying recesses in the common rock, there occur minerals of a different character. Masses of pink lepidolite, associated with laminar albite, smoky quartz, cleavable masses of amblygonite, cookeite, and variously colored tourmalines; silvery white mica containing apple-green, friable tourmalines; and usually opaque greenish or nearly white beryls.

Contiguous with these curious associations of minerals, pockets are met with filled with decomposed albite, crystals of smoky quartz, detached botryoidal masses of cookeite and tourmalines. The finest specimens of the latter are raked together with the other loose contents from the pockets. They are also found imbedded in some of the more solid associated rocks, the lepidolite, the cookeite, and the smoky quartz.

The tourmalines are remarkable, being usually partly colored of various shades of green passing into red, and partially opaque to transparent. Small crystals from half an inch to an inch and a half in length, and from half a line to the fourth of an inch in thickness, occur abundantly imbedded in the cookeite. In spongy masses of the latter, they appear closely invested with thick sheaths of the same substance. These smaller tourmalines are usually bright grass-green, and transparent, but others are nearly colorless, and green or pink at one end. Frequently they are fissured, partially decomposed, and sometimes the decomposition extends along the axis, so as to render the crystals tubular.

The tourmalines of the pink lepidolite usually occur in compa-

nated, with one extremity flat, and the other three-sided, with the angles or borders truncated.

Sometimes the crystals occur opaque, dark green at one end, becoming bright grass-green and transparent at the middle, and passing into cherry or rose-red and transparent at the other end. Occasionally the green color is nearly absent, and we have an achroite with a greenish hue, passing successively into a deeper shade of green and dark green, or into pink and deep cherry-red, usually sheathed with a thin layer of greenish hue at the opposite end.

In a crystal exhibited, measuring four inches in length by three-fourths of an inch in diameter, flat at one end, and three-sided at the opposite end, the first inch is dark opaque green, the second inch is bright grass-green and transparent, the third inch is pale pink within and pale green without, and the fourth inch is cherry-red within and pale green without.

A segment exhibited of a transparent prism of achroite, an inch long and an inch and a half in diameter, has upon one end a patch of cookeite. This mineral often occurs investing the ends, fractured surfaces, and sides of the tourmalines.

Another specimen exhibited consists of a crystal an inch and a half long and ten lines thick, with a three-sided termination, deeply striated, and of a dark green color. Broken across near the base, the interior exhibits a spherical nodule of transparent achroite the third of an inch in diameter.

Some magnificent crystals of the kind indicated have been for many years in possession of Dr. Hamlin and his father, who first discovered the locality from whence they were obtained. Dr. Hamlin has more recently thoroughly explored the locality and investigated the character of its tourmalines, an account of which he proposes to give us in a future essay on the subject.

---

OCTOBER 17.

The President, Dr. RUSCHENBERGER, in the chair.

Nineteen members present.

*Remarks on Fossils from Oregon.*—Prof. LEIDY directed attention to some fossils, part of a collection from Oregon, submitted to his examination by Rev. Thomas Condon, and indicated in the Proceedings of October 18th, 1870.

One of the fossils, a brain cast, or rather a cast of the interior of the cranium of a large mammal, has about the same form and size as that of the horse. The cerebral hemispheres are nearly as much convoluted as in the latter, and measure about four and a half inches in length and breadth. It may pertain to a large tapiroid animal, though I suspect it belonged to an oreodont.

1872.]

A large atlas, perhaps belonging to the same animal as the former specimen, measures five inches in breadth between the outer prominent borders of the articular concavities for the occipital condyles, and it is about four and a half inches from the neural tubercle to the hypapophysis. It differs in several important points from the atlas of the rhinoceros, horse, ox, etc., and the want of sufficient means of comparison prevents a determination of its near relationship.

Another fossil, labelled "Alkali Flats," consists of the greater part of the crown apparently of a last upper premolar or perhaps of a transverse pair of lobes of a true molar, of an animal as large as that to which the preceding specimens belonged. The tooth approaches in character the corresponding portion in the oreodonts, but differs in the proportionately less degree of development of the inner lobe of the crown as compared with the outer one, and in the greater degree of development of the inner basal ridge. The crown measures an inch and a third in transverse diameter. These fossils appear to indicate an unknown pachyderm, which may be designated by the name of *HADROHYUS SUPREMUS*.

Among the Oregon fossils there are a number of imperfect remains, of which it was formerly remarked, they indicated at least two species of rhinoceros. One of these was thought to be the same as the *R. occidentalis*; the other was suspected to be the same as the Californian species, *R. hesperius*. Some additional specimens indicate the second species to have been intermediate in size to that last named, and the *R. crassus* of the Niobrara River. One of the specimens from Bridge Creek, consisting of a mutilated upper jaw fragment with portions of the fangs of the true molars, shows these to have occupied a space of about five inches. An isolated tooth, from Alkali Flat, apparently a last upper premolar, probably belongs to the same animal. From the outer part of

OCTOBER 24.

The President, Dr. RUSCHENBERGER, in the chair.

Eighteen members present.

---

OCTOBER 31.

The President, Dr. RUSCHENBERGER, in the chair.

Twelve members present.

On report of the committee, the following paper was ordered to be printed:—

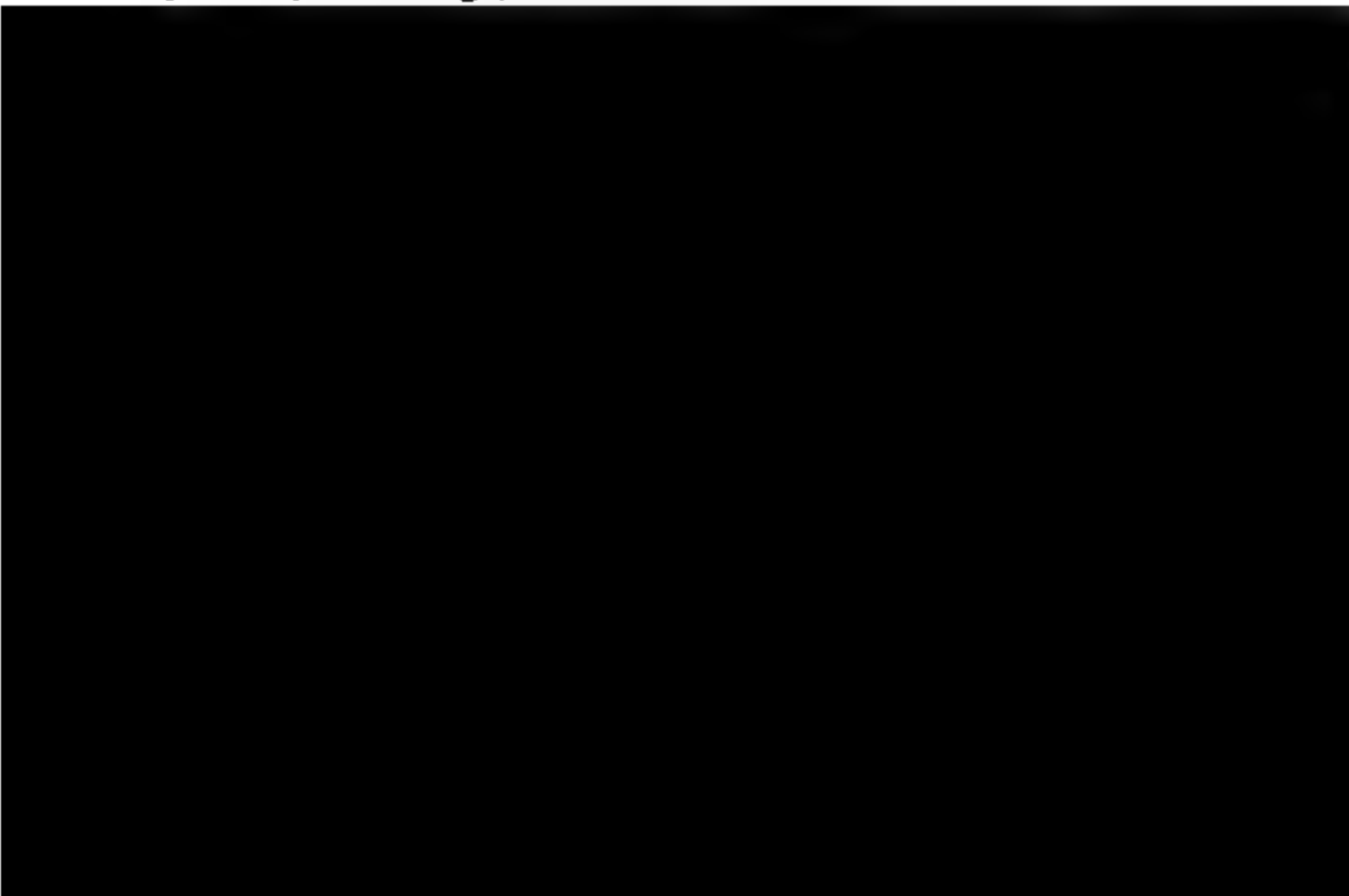
## ON THE FISHES OF THE AMBYIACU RIVER.

BY EDWARD D. COPE.

The collection on which the present examination is based was made by our correspondent at Pebas, John Hauxwell. It embraces fishes of the small streams tributary to the Ambyiacu, as well as those of the river itself. The Ambyiacu is an inconsiderable river, which empties into the Amazon near to Pebas, in Eastern Equador, some distance east of the Napo.

The results of the examination will be mentioned at the close of the list. As was to have been supposed, it consists almost exclusively of representatives of the three great families which abound in the neotropical region; the *Chromididæ*, representing Physoclystous fishes, and the *Characinidæ* and *Siluridæ*, representing the Physostomi. The number of new species, forty-five in a total of seventy-four, constitutes a considerable addition to ichthyology, especially as the number of new generic forms is also rather large.

I add a list of the species obtained by my friend Robert Perkins, of Wilmington, Delaware, on a trip between the mouth of the Rio Negro and the Peruvian Amazon or Ucayale River. There are several interesting novelties in this collection, but their special localities are, unfortunately, not preserved. The specimens generally were large, and in fine condition.



body, nearly four inches in length (with caudal); depth, 3.5 times in the same. Orbit, twice preorbital bone, equal muzzle, one-fourth wider than interorbital space, one-third head.

Total length .063 m.; to basis anal .0335; do. ventral .019; do. dorsal (axial) .015 m. Color brown; a black band from orbit to basis caudal. A black spot at base, and one at tip of caudal. Basis of dorsal and anal brown, rest yellow. A black band from orbit to angle of interoperculum. Cheeks and operculum with blue spots separated by yellow lines. River Ambyiacu.

**GEOPHAGUS BADIIPINNIS**, Cope, sp. nov.

Form short oval; body deep; front steeply descending, concave between the orbits; the muzzle projecting. Depth one-half length without caudal fin; head 2.4 times in the same. Orbit 3.5 times in length of head; 1.3 times into interorbital space, which equals length of muzzle with under jaw. Preorbital bone .75 the diameter of the orbit. End of maxillary bone falling opposite the pupil. Fin rays D. xiii-12, A. iii-11. Scales 3-27-8-10; six series on the cheek; operculum scaled. Twelfth dorsal ray equal length of muzzle plus half of orbit; the rays gradually diminishing in length to the second. Caudal fin broadly scaly at base; no scales at base of second dorsal. Pectoral fin long, extending to opposite last soft dorsal ray; ventrals to third soft anal.

Color golden, blue bands on the prefrontal bone, and longitudinal shades on the scales. Dorsal fin dusky spotted, anal with numerous bay-yellow spots in vertical rows. Total length .15 m.; to origin dorsal (vertical line) .043; do. to ventral .051; do. anal .084.

This species, having the coloration of *G. jurupari*, has the orbit nearly as median as in *G. læniatus*. I do not see the necessity of subdividing Heckel's genus *Geophagus* into three (*Geophagus*, *Satanoperca*, and *Mesops*), as has been proposed by Günther (Catal. Brit. Mus.).

**GEOPHAGUS JURUPARI**, Heckel.

*Satanoperca jurupari*, Günth. Cat. B. M. v. 313.

D. xv. 10, A. iii. 7. Scales 3-31-9; suborbitals 6 (7) rows. Preorbital bone 1.66 times orbit.

**CRENICICHLA ANTHURUS**, Cope, sp. nov.

A slender species, with brightly colored fins. Depth six times in total length, or 5.3 times in length without caudal fin. Length of head 3.66 in total length, five and two-third times more than the diameter of the orbit. Orbit 1.7 times in muzzle, 1.6 times in interorbital width, which is flat. Scales  $4\frac{1}{2}$ -36-7-13, but, as those of the lateral line are placed at intervals, the true number of transverse series of scales is 62.3; scales of cheek in nine series. Fin radii, D. xix-13; A. iii-9. Caudal cuneate rounded; pectoral and ventral coequal, not extending half-way to anal. Twelfth dorsal spine equalling from end of chin to orbit. Some rays of soft dorsal and anal prolonged, the former to near end of caudal, the latter to base.

Color leaden-brown above, fading into yellowish below. Dorsal and anal fins deep rose, with a few round small spots of pale rose on the soft portions, which become white in spirits. Caudal fin deep crimson, fading to purple at base, with a longitudinal dark shade in the centre, and series of small oval pink spots, one between each pair of rays. A black spot edged with white at the base above the lateral line, and a larger black spot, white-edged, crossing the lateral line opposite the third, fourth, and fifth dorsal spines.

Total length .215 m.; to basis dorsal (axial) .055 m.; to basis of anal .121.

This perch appears to be similar to the *C. lacustris* of Castelnau in proportions, but the coloration is very different. I have

1.33 times to 1.6 times in interorbital breadth. Scales 4—56-3<sup>1</sup>—12 13, seven rows on cheek. Color olivaceous, blackish above; fins dusky, without markings, except a black ocellus at upper base of caudal fin, with pale margin. A dusky band from end of muzzle to middle of side, and dusky spot below eye. Eye red. Total length .17 m.

*Var. α.*—Shorter and stouter, colors paler. Eye 1.5 times in interorbital width. Depth of body 3 $\frac{1}{2}$  to 4 times in length less caudal. Scales 4—45-8—13. Pattern of color similar to the last. Several specimens.

*Var. β.*—More slender; depth 4.66 times in length without caudal fin. Radii xviii-14; A. iii-9. Scales 4-55-13. Diameter of orbit equal interorbital space. Coloration as in the types, except a large black spot marking the posterior fourth of the spinous dorsal fin. This variety has one less dorsal spine than usual in the type, but the latter occasionally exhibits but 18.

*Var. γ (argynnis).*—Short and stout as in var. α, but the orbit is as wide as the narrowed interorbital space; scales 4-43-13. Radii D. xix. 13; A. iii. 9. The coloration is like that of the type, olive, darker above, with caudal ocellus and dusky band from muzzle to opercular margin. The dorsal fin has, however, a broad orange-red band extending along its distal posterior half, the anterior part wider and with three large black spots in the centre; in a second specimen it contains four black spots.

The preceding varieties are so connected together as to be inseparable in our system. The var. β accords to some extent with Castelnau's description of his *C. lacustris*, but our most slender forms are less elongate than this species, where the depth is one-sixth the length. There are neither black dots nor vittæ in the *C. proteus*. From *C. saxatilis*, to which it is next allied, it differs in the constantly smaller number of longitudinal scales, which are given by Günther as  $\frac{7}{14}$ .

#### UARUS INSIGNIS, Heckel.

*Mesonauta insignis*, Günther, l. c. iv. 300.

#### UARUS CENTRARCHOIDES, Cope, sp. nov.

Form a compressed broad oval. Scales ctenoid 7—29-20—14, five series on the cheek; operculum scaled. Radii D. xv-14; anal

<sup>1</sup> Not counted on lateral line.

viii-12. Caudal fin subtruncate. The middle dorsal spines appear to be longer than the posterior, but the latter with the two anterior pointed rays have been bitten nearly off, causing a deep and regular emargination of the two fins, so that the normal form is not certain. Pectoral and ventral fins extending to near the eighth anal spine. Teeth in several series in both jaws, those of the external cylindric considerably larger. End of maxillary extending but little behind the line of the posterior nareal opening. Profile steep, concave and flat between the orbits, where its width a little exceeds the diameter of the orbit. Latter one-third of head equal length of muzzle. Depth of body 1.5 times the length without caudal fin.

Color dusky, with seven vertical blackish bars extending below the basis of the dorsal fin, which break into spots on the belly; a cross-bar through eye, and one across base of tail. Soft dorsal with whitish cross-bars, other fins blackish.

Total length .074 m.; to line of D. I. .02 m.; to line of A. I. .03; to basis of caudal .055.

This species is intermediate in characters in some respects between the species referred by Günther to *Uarus*, Heckel ("*Uaru*"), and those referred to *Mesonauta*, Günther. I fail to perceive any characters on which to establish the latter, and accordingly regard its species as referable to the present genus.

**HEROS BIMACULATUS, Linn.**

*Acara bimaculata*, Günther, l. c. 276; *A. gronotii*, *punctata et margarita*,

**ACARA TETRAMERUS**, Heckel.

Günther, Catal. iv. 277.

**ACARA SYSPILUS**, Cope, sp. nov.

Scales in three series on the cheek, on the body 2-26-7. Radii D. xiv-xv. 9; A. iii. 8; caudal rounded. Form elongate oval; depth of body 2.6 times in length without caudal fin, and equal depth of head. Preorbital bone half orbit (in specimen two inches long); orbit 2.5 times, head nearly twice interorbital space (doubtless much smaller in larger specimens). Profile convex; muzzle oblique; upper lip longer than mandible.

Light brown, yellow below. A straight wide black band from the upper posterior margin of the orbit to below the end of the spinous dorsal, composed of three confluent spots; a black bar from eye to angle of preoperculum, and another across the base of the caudal fin. Seven vertical brown cross shades behind the head, on sides.

**ACARA FLAVILABRIS**, Cope.

Proc. Amer. Phil. Soc., 1870.

Scales in two series on cheek; on body 2-24-8. Radii D. xvi. 9-10; A. iii. 7. Depth 2.25 times, head 2.8 times in length less caudal fin. Eye three times length of preorbital bone, and 2.6 times in head in specimen 2.5 inches long, jaws equal. Seventh dorsal spine as long as diameter of orbit or interorbital width. Profile gently convex, inferior outline rising to meet it.

Olive, with jointed unpaired fins yellow. A large black spot before middle of side on lateral line, a vertical shade at base of caudal.

As compared with *A. dimerus*, its closest ally, this fish differs in the fewer anal radii, the lack of cross-bars, etc. It was originally described by me as having three rows of cheek scales; but those of the interoperculum were included.

**ACARA FRENIFERUS**, Cope, sp. nov.

Scales of cheek in two series; of body 2-29-8-9. Radii D. xvi. 10-11; A. iii. 8. Form elongate oval, the depth entering the length (less caudal) 2.33 times. Front convex, descending, length of head one-third length. Orbit equal muzzle 3.33 times in head, 1.5 times in the flat front. Dorsal spines short, twelfth equalling 1872.]

diameter of orbit. Pectoral not reaching anal; soft anal and dorsal not quite reaching end of caudal; latter rounded.

Color rich brown, with a black spot under the middle of the dorsal fin, which is connected with the orbit by a broad black band. The body is further crossed by five darker shades. Fins dusky. Below brown, under lip yellow.

Total length .117 m. to line of D. i. .027; do. of anal .058.

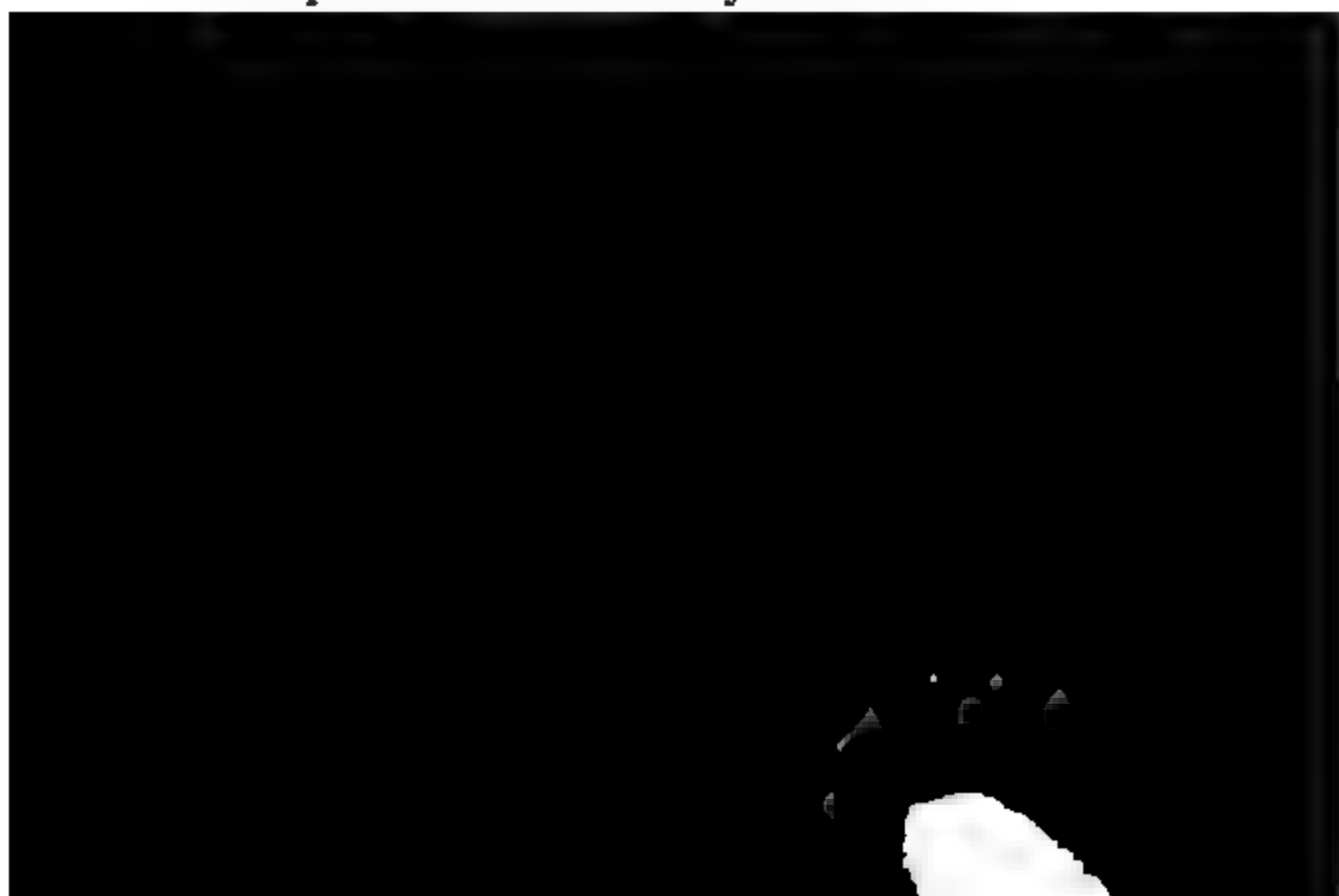
Several specimens from the Ambyiacu. This species is, with *A. dimerus*, Heckel, and *A. flavilabris*, Cope, the only one with two series of cheek scales. It differs from the first named in the much fewer fin radii, etc.

**ACARA COMPRESSUS, Cope.**

Scales 35, transverse series, seven rows on the cheek. Radii D. xiii-19; A. iii-15. Longest dorsal spine as long as muzzle and half the orbit. Form oval, depth half length less caudal, body compressed. Profile oblique, nearly straight from in front of dorsal fin. Head 2.5 times in length less caudal; orbit 3.2 times in head, larger than muzzle 1.2 times in interorbital space. Left dorsal and anal prolonged. Outer series of teeth larger. Total length .079 m.; to dorsal (axial) .024; to anal (do.) .0395; to caudal fin .0595.

Color, injured by the alcohol, at present uniform brown, with a black line from the angle of the mouth to that of the preoperculum, and two black shades, one at base and the other at end of caudal fin. Soft dorsal and anal black behind.

Two specimens from the Ambyiacu.



lobe shorter than inferior. Orbit entering head (with chin) four times, in muzzle once, nearly double interorbital space. Pectorals reaching beyond basis of ventrals. Cranial ridges forming a closed V in front. Length of head equal greatest depth of body, entering length 3.75 times (excl. caudal fin).

Total length .186 m ; to basis of anal .093 (axial); do. ventral .061.

Silver with golden and green reflections, yellow on side of head, a black epiclavicular spot.

From the Ambyiacu. The second South American species, which is found at a great distance from salt water.

### OSTEOGLOSSIDÆ.

**OSTEOGLOSSUM BICIRRHOSUM**, Vand.

Three specimens ; in one the anal and caudal fins are united.

### STERNOPYGIDÆ.

This family differs materially from the *Gymnotidæ*, with which its species have been heretofore arranged. One character is to be seen in the construction of the scapular arch. The coracoid bone is well developed, and connected by the transverse column with the clavicle, as in many other physostomous families. In the *Gymnotidæ* this column is wanting, and the coracoid is rudimental.

**STERNOPYGUS MACRURUS**, Cuv.

**STERNOPYGUS VIRESCENS**, Valenc.

**CARAPUS FASCIATUS**, Pallas.

### ERYTHRINIDÆ.

**MACRODON TRAHIRA**, Bl. Schn.

Günther, Catal. v. 281.

**HOLOTAXIS LÆTUS**, Cope, sp. nov.

Form elongate, scales very large, l. l. 26, l. tr. 5. Length head four times depth body, also four times in length without caudal fin. Orbit 3.3 times in length of head. Chin very prominent ; maxillary teeth as large as the premaxillaries. Dorsal fin distant from muzzle 1.5 times distance from caudal. Radii D. I. 9 ; A. 1872.]

10; V. 8. Pectoral reaching ventrals, ventrals filamentous, reaching anal, commencing in front of dorsal. Dorsal with median rays, and caudal with longest rays filamentous.

Color, scales orange at base, with broad blackish margins forming rows of spots; dorsal fin with a black spot at middle and a large black saddle below and in front of it on the back; mandible black-edged; fins orange-red. Total length .0755 m.; to dorsal fin .0335; to ventrals .027; to anal .0416.

This is the second species of this genus, which was characterized by the writer, *Proceedings Am. Phil. Soc.*, 1870, p. 563. It differs from the type *H. melanostomus*, in the larger scales, there being 5 in this, 7 in that, in a cross series.

### CHARACINIDÆ.

#### *CURIMATUS CYPRINOIDES*, Linn.

*Syst. Naturæ*; Günther, *Cat. B. M.* v. 290.

#### *CURIMATUS RUTILOIDES*, Kner.

*Denkschr. Wien. Acad.*, 1859, 141. Günth. v. 290.

Both these species quite abundant.

#### *PROCHILODUS INSIGNIS*, Kner.

*Denkschr. Wien. Acad.*, 1859, 147. Günth. v. 296.

D. 11, A. 10. L. l. 44, l. tr. 22. Depth 2.5 times in length; head three times. Silver-lead above; caudal with two black cross-bands forming chevrons with the angle directed distally.

**LEMOLYTA TÆNIATA**, Kner.

*Schizodon tæniatus*, Kner. Denkschr. Ac. Wien, 1859, 159. Gthr., v. 304.

**LEPORINUS MEGALEPIS**, Günth., var.

Catal. B. M. v. 307.

Three adult specimens, two with deeper, one with shallower body. First, scales  $4\frac{1}{2}$ –35–4; head 3.5 times, depth three times in length. Second, scales 5–37–5; head 3.75, depth three times in length. Third, scales 5–38–5; head 3.75, depth 3.6 times in length. All with anal rays 10, and a minute anterior spine. Ten dark dorsal cross-bands besides the three lateral spots; the appropriate bands descending between the spots. The young are very strongly and handsomely cross-banded.

**CHARACIDIUM ETHEOSTOMA**, Cope, sp. nov.

The discovery of this little fish is interesting as extending the range of this genus over the whole of Brazil, it having been known heretofore from the neighborhood of Lagoa Santa, from a tributary of the coast river, the Rio das Velhas. Prof. Reinhardt, who discovered it, called the species from that locality *Ch. fasciatum*.<sup>1</sup> The nares are separated, the anal fin short, the teeth are simple, acute, and fixed in a single series in each jaw; none on the maxillary. Lateral line complete.

The species here described has much the coloration of the *Poeciliichthys* or *Etheostoma* of our North American streams.

Depth into length 5.25 times; head 5.75 times in same. Branchiostegal membranes fissured far forwards. Dorsal fin commencing in front of ventrals R. 11; A. 8; V. 9; P. 11, reaching ventrals, ventrals reaching anal, caudal deeply forked. Scales l. l. 33, l. tr. 8; striate. Orbit equal muzzle 3.6 times in head, equal inter-orbital width, and length of muzzle; profile nearly straight, lips about equal; maxillary bone to orbit.

In spirits yellowish, probably hyaline in life, with a black lateral band from end of muzzle, and nine quadrate brown dorsal spots from nape to tail. There is more or less connection between the spots and band, and shades across the under side opposite to these. Fins unicolor, light. Sides of head silver, end of chin,

<sup>1</sup> See K. Dansk. V. Selsk. Forh., 1866, 55, Tab. II. f. 1.

and a vertical bar at base of caudal fin black. Total length .048 m.; to dorsal .0175; to anal .03; to basis caudal .039. The opercle of one of the specimens is white and smooth, of another punctate-rugose and yellow.

**IGUANODECTES, Cope, gen. nov.**

Dorsal fin originating in advance of ventrals, anal elongate. Branchiostegal membranes united across, but not with, isthmus. Teeth in two series in the premaxillary, none in the maxillary, and one row in the mandible. They are fixed, but have contracted fangs, and broad, flat, subequally denticulate crowns, and those of the mandible stand out from the dentary bones all round. Teeth of the outer row very few, minute. Caudal fin furcate.

This genus is allied to *Tetragonopterus*, but the dentition is much weaker, approaching that of the *Schizodon*; the union of the branchiostegal membranes is seen in *Læmolyta* m. In the only species there are but two minute teeth of the outer premaxillary row. The other teeth are fan-shaped and smooth, and in contact, so as to form an uninterrupted series. In *Tetragonopterus* the fangs are strong, not contracted, and the crowns are ridged.

**IGUANODECTES TENUIS, Cope, sp. nov.**

Slender, the depth entering the length (without caudal) 5.5 times, length of head 4.33 times in the same. Radii D. 12; A. 36; V. 9, P. 13. Pectoral reaching ventral and ventral anal. Orbit 3.2 times in head, equal interorbital width, less than length of

**TETRAGONOPTERUS PHENICOPTERUS**, Cope.

D. 10; A. 26-7; ventrals originating in front of dorsal, not reaching anal; pectoral reaching ventral. Scales  $5\frac{1}{2}$ -35-4. Depth of body 3.3 times in length without caudal; length of head 4.2 times. Orbit 2.5 times in head, equal the plane interorbital space.

Silvery, with lateral silver band and indistinct scapular and basal caudal blackish spots. Anal and dorsal fins vermilion; caudal with a triangular vermilion spot which surrounds the basal black spot, and whose apex reaches the caudal emargination.

Length .053 m.; to dorsal .021; to anal .0245.

Apparently very abundant. It is allied to the *T. carolinæ* of Dr. Gill (Proc. Ac. Nat. Sci., Phila.), 1870, p. 92, but is a more slender fish with smaller head.

**STETHAPRION CHRYSÆUM**, Cope, sp. nov.

Form elevated, disciform; scales small, 19-67-16. Radii D. 12; A. 37; V. 8, very small, not reaching anal, and commencing below dorsal. Pectoral falcate reaching nearly to line of end of ventrals. Base of anal fin covered with scales, especially anteriorly; dorsal with a long decurved spine in front of it. Caudal peduncle contracted. Depth into length less caudal fin, 1.66 times, length of head 3.4 times. Orbit 2.4 times in head, much larger than muzzle's length, 1.1 times in interorbital width. Profile of head very concave. Dorsal fin elevated, caudal deeply bifurcate. Lateral line a little decurved medially.

Color silvery, a leaden shade from postscapular region to caudal fin, darkest in front at a postscapular spot. Below this band, yellow. Fins unspotted. Total length .071 m.; to dorsal fin (oblique) .03; to caudal (straight) .053; to ventrals (oblique) .032 m.

This species is near the type *S. erythrops*, Cope (Proc. Am. Phil. Soc., 1870, p. 562, fig. 5), but has larger scales and a different coloration. The genus *Stethaprion* has the physiognomy of *Mylietes*, but is essentially near to *Tetragonopterus*. It differs from the latter chiefly in the decurved spine in front of the dorsal fin, a character it shares with *Serrasalmo*.

**BRYCON CAPITO**, Cope, sp. nov.

Scales small, L. l. 56, l. tr. 25. Depth of body one-fourth, length of head one-third of total without caudal. Radii D. 10; 1872.]

A. 25; V. 7 (8?). Dorsal originating a little behind line of ventral, pectoral reaching ventral. Orbit 2.66 times in head, equal interorbital width. Middle series of premaxillary teeth continued outwards as far as the exterior. Posterior pair of mandibular teeth very small. Color leaden, head silvery, a scapular and large basal caudal black spot.

Total length .06 m., to dorsal fin .0275, to anal .034.

**CHALCEUS MACROLEPIDOTUS**, Cuvier.

Cuv. Val. xlii. 240. Günther, Cat. B. M. v. 383.

Two teeth only in posterior mandibular series.

**CHALCEUS ERYTHRURUS**, Cope.

*Plethodectes erythrurus*, Cope, Proc. Am. Phil. Soc., 1870, p. 563, fig. 6.

This species belongs to *Chalceus*, but differs from the type in having scales of equal size. Günther says of this genus in his analytical key, "anal fin more or less elongate," as distinguished from "anal short" of *Piabucina*, yet *C. macrolepidotus* has as many anal radii as *P. erythrinoïdes*. *Oreagrus*, with a fin of about the same length, is placed in the "elongate" anal division.

**MEGALOBRYCON MELANOPTERUM**, Cope, sp. nov.

Rather stout; dorsal outline arched. Length of head three and three-fifths times in total lacking caudal fin, depth three times in same. Orbit large, equal muzzle, 3.5 times in head. Radii D. 11;

fins white. A black scapular spot, and a crimson spot at the apex of each operculum. Opercular bones with purple reflections. The Ambyiacu.

This genus was proposed by Günther, in 1869 (Proc. Zool. Soc., p. 424), on the type species, *M. cephalus*. This fish is evidently nearly allied to the species here described, but is different from them in the larger size of the external series of premaxillary teeth, since they are, according to Günther, double the size of the maxillaries, nearly in contact, and apparently more denticulate. It is about as stout as the present fish, but the arrangement of the posterior series of teeth is similar to the *M. erythropterus*. I have two specimens of the *M. melanopterus*, and they agree in every detail.

**MEGALOBRYCON ERYTHROPTERUM**, Cope, sp. nov.

More elongate; length of head equal depth, and one-fourth the length without caudal. Orbit large, 3.5 times in head, 1.8 times in interorbital width. Radii D. 11; A. 23; V. 8, commencing opposite a point equal to five radii in front of the dorsal fin. Pectorals 12, not reaching ventrals. Squamation injured, lateral line estimated 70. Teeth similar to the last, except that there are twelve premaxillaries on each side, and that those of the posterior row at each end, instead of being continuous with the larger median teeth of that row, are continuous with the lateral limbs of the median M-shaped row, as in *M. cephalus*.

Total length  $7\frac{3}{4}$  inches, = .19 m., to dorsal fin .086 m., to anal .115. Color pale and uniform, with a black scapular and large basal caudal spot, which is prolonged as a band to the margin of the fin. Rest of caudal and all the other fins, except base of dorsal, crimson. Sides of head with pearly purple reflections.

Though the characters separating these species are few, they are important. They are found in the form of body, position of dorsal fin, anal radii, color, and dentition.

From the Ambyiacu.

**TRIPORTHEUS**, Cope, gen. nov.

Dorsal short, anal elongate. Teeth in three series on the premaxillary bone, denticulate, in two rows on the mandible, the posterior of the latter consisting of two convex median teeth. Pectoral region compressed and keel-shaped on account of the 1872.]

development of the coracoid bones; abdomen compressed. Dorsal fin behind the line of the ventrals.

This genus has a considerable resemblance to *Chalcinus*, and is intermediate between it and *Chalcinopsis*, Kner. The former has two series of premaxillary teeth, the latter four; the present possesses three. The *Chalcinopsis alburnus*, Gthr., probably belongs to *Triportheus*.

**TRIPORTHEUS ALBUS**, Cope, sp. nov.

Teeth of the premaxillary closely packed, many denticulate; chin projecting beyond muzzle when the mouth is closed. Radii D. 11; A. 27; ventrals longer, extending to beyond the last ray of the dorsal. Pectorals falcate, not quite reaching end of ventrals. Caudal deeply emarginate. Scales large l. l. 28, five series above the lateral line. Head 3.5 times in length without caudal; orbit large, exceeding interorbital width a little, and three times in length of head (including chin).

Color dark ashen above, sides and below silver-white; a dark spot at basis of caudal fin. Total length m. .061; length to basis of dorsal fin .0292; from D. I. to basis caudal .02. The dorsal outline of this species is regularly arched.

From the Ambyiacu.

**TRIPORTHEUS FLAVUS**, Cope, sp. nov.

Premaxillary teeth spaced, the anterior series in contact only exteriorly. When the mouth is closed the chin projects but little, and the profile of the head descends obliquely from that of the back. Dorsal fin gently arched. Radii D. 11. C. 20. A. 20. V. 7.

**CHALCINUS CULTER**, Cope, sp. nov.

An elongate species, with very posterior dorsal fin. Height at pectoral fin 4.33 times, at ventral five times, in length without caudal fin. Head 3.75 times in the same; orbit 3.8 in head and 1.2 in interorbital space. Head above flat in one plane from end of muzzle to dorsal fin. Teeth small tricuspid, those of exterior row not in contact with each other. Dorsal fin short, its last ray opposite first anal; distance from base of caudal a little more than half distance from end of muzzle. Pectorals falcate, reaching nearly to line of dorsal. Radii D. 11; C. 19; A. 33; V. 8; P. 11. The inferior caudal rays are shorter than the median and superior; ventrals reach to line of dorsal. The operculum is nearly as long as high. Scales 7-40-3.

Color pale golden; head silver, the upper part of the operculum with steel-blue reflections, bounded by a groove. A round black spot on base of median caudal rays.

Total length .158 m.; length to dorsal fin .087, to anal .098.

This species is nearest the *C. nematurus*, Kner, but differs from it in many important respects.

**GASTEROPELECUS STELLATUS**, Kner.

Denkschr. Ac. Wiss. Wien., 1860, 17 Tab. I. f. 2; Günther, Catal. B. M. v. 343.

**RÆBOIDES MYERSII**, Gill.

Proc. Ac. Nat. Sci. Phila., 1870, p. 93.

D. 11, A. 52; scales 22-83-22. Head 3.4 times in length. Prof. Gill does not give the number of scales in his description, and our fishes differ from his in the less depth, which enters the length 2.7 times instead of 2.5, and the larger eye, which enters the head three times instead of 3.5 times.

**RÆBOIDES RUBRIVERTEX**, Cope, sp. nov.

Radii D. ii., its anterior rays 1.2 times as long as the head; A. 51. Depth 2.66 times in length, length of head four times in same. Scales 27-88-19. Ventral fin reaching anal, pectoral not reaching end of ventral. Length from dorsal to near end of adipose equal from same to end of muzzle (much less in *R. myersii*). Profile gently concave above, dorsal line very convex; top and sides of head rugose. Exterior teeth 3 above, 4 below; mandi- 1872.]

bulars in one row, with four canines. Two rows of premaxillaries, the posterior wanting medially. In *R. myersi* the middle row of teeth is so curved as to be continuous with the posterior series.

Scapular and caudal spots indistinct; general color pink. Top of head, maxillary bone, and opercula crimson; fins immaculate. Total length .135 m.; length to anal .059; to adipose dorsal .098; to first dorsal .057. This is a larger fish with a smaller head than the *R. myersi*. It may possibly prove to be the *R. affinis*, Günth., Pr. Z. S., Lond., 1868, 246, but he describes "anal rays 55, scales l. l. 80," and the dorsal fin appears to be more posterior.

**ANACYRTUS SANGUINEUS, Cope, sp. nov.**

A stout species with large scales. Sc. 12-54-12; radii, D. 9; A. 43; V. 8, reaching anal; P. 16, to middle of ventrals. Back much elevated, dorsal commencing in front of anal (A. i. opposite D. 4), and nearer end of muzzle than basis of caudal by a little. Caudal deeply forked. Depth 2.6 times in length (caudal), and length of head 3.4 times in the same. Eye four times in length of head in adults, equal interorbital width. Operculum and orbital bones rugose.

Premaxillary teeth in two very distinct series, a canine at the inner, and one at the outer extremity of the bone. Maxillary toothed to the end, which is behind the line of the posterior margin of the orbit. Mandibular teeth with two (or three on one side of one) canines on each side.

Color pale, with a large black spot on the line from the front of

**XIPHOSTOMA TÆDO**, Cope, sp. nov.

D. 10, A. 10; scales of lateral line 75. Last dorsal ray above the fifth anal. Head (without membranous flap) three times in length to basis of caudal; eye 7.6 times in length of head, of which four times enter muzzle (without flap); flap equal one diameter of eye; interorbital space flat, 1.75 times diameter of orbit. Muzzle flat above, decurved, receiving the mandibular teeth within it, striate rugose. Teeth minute, equal. A rudimental dermal flap on mandible. Pectoral fins reaching less than .3 distance to ventrals; rays 15; V. 8; extending half-way to anal. Caudal emarginate. Depth of body at ventrals 7.75 times in length without caudal.

Color light brown above, below white; two series of small brown spots on each side, above. Top of head rosy; dermal flap of muzzle vermilion, black-edged. Opercula golden, suborbital bone with purple reflections. Dorsal fin yellowish, with two brown cross-bands; anal with a median black spot. Caudal fin with middle and tips black, margin and space between, with rays, white.

Total length .203; to orbit .036; to ventral .112; to dorsal .1382; to anal .1432; to caudal fin .178.

Two specimens from the Ambyiacu.

**MYLETES ALBISCOPUS**, Cope, sp. nov.

Discoidal, with small head; anal rays long, the fin half covered with scales. Radii D. 17; A. 36; V. 7. Caudal fin subtruncate. Scales small, 41–100–45. Forty-seven spines in front of the anal fin. Profile scarcely concave, orbit 3.5 times in head, a little less than half the superficial width of the very convex interorbital space. Length of head 3.75 times in total, lacking caudal; depth 1.4 times in same. Anterior teeth separated from posterior. Pectoral fin to ventral, ventral commencing under dorsal. First ray small, not reaching vent. Length .16 m.; to line of dorsal (axial) .065; to line of anal (axial) .09; to caudal .125.

Color silvery, with blue reflections above, and golden below. A black spot on posterior edge of operculum; otherwise immaculate.

Numerous specimens from the Ambyiacu. Two from the Perkins collection lack the opercular spot.

**MYLETES OCULUS**, Cope, sp. nov.

Premaxillary series of teeth in contact. Radii D. 15; A. 24; V. 7, reaching the vent, and commencing below the first dorsal ray. Pectorals reaching base of ventrals. Preanal spines 43. Form stout ovate, dorsal and ventral curvatures equal. Depth 1.75 times in length without caudal; length of head 2.5 times in same; caudal fin bifurcate. Orbit 3.3 times in length of head (of an individual .065 m. long), 1.75 times in the rather flat inter-orbital space. Profile concave, operculum rugose. Depth of above individual .0275 m.; length to dorsal fin .03; to anal .037.

Color dark plumbeous, with a black spot with a wide white bordering ring just above the lateral line below the anterior part of the dorsal fin. Many specimens with vertical dark shades or fasciæ. Anal fin blood-red, black at base.

This species is well distinguished by its stout head and jaws, and especially the ocellus on the side. The details do not agree with those of any described species.

**MYLETES HERNIARIUS**, Cope, sp. nov.

Form subquadrangular or broad diamond-shaped from the angular elevation of the back, and the abrupt prominence of the abdomen. The thoracic outline is concave below the pectoral fins. Radii D. 18; A. 32; ventrals reaching vent, not attained by the small pectorals. Abdominal spines of unusual length, spine-shaped, 46 in number. Depth 1.4 times in length without caudal fin; length of head three times in same. Orbit one indi-

than interorbital space. Ventral fin originating opposite front of dorsal; not reaching vent; pectoral reaching ventral. Bones of head striate. Caudal fin openly emarginate. Color pale fawn-color above, below silvery; four longitudinal series of round black spots above lateral line; several scattered spots below it. Opercular apparatus brilliantly colored; upper part of preoperculum and orbital bones green; middle golden, lower part purple and violet. Operculum purple above, vermilion below; interoperculum vermilion; anal fin the same; caudal brown, edged with pale yellow centre.

Total length .104 m.; to dorsal .0535; to ventral .0475; to anal .0615; to caudal .084.

This brilliant species is especially peculiar in the number of its abdomino-thoracic dentations.

From the Ambyiacu.

**SERRASALMO ÆSOPUS**, Cope, sp. nov.

Radii D. 16; A. 32; V. 7; pectoral falcate reaching basis of ventral. Form short, deep, dorsal curve greater than abdominal. Depth 1.66 times in length without caudal, length of head three times in the same. Scales 47-83-36; ventral spines 31. Muzzle very short, only half as long as diameter of bony orbit, which is contained four times in the length of the head, and twice in the interorbital space. Latter convex transversely. Lateral line slightly decurved in the middle. Dorsal fin nearer the base of the caudal (first fulcrum) than the end of the muzzle, by the length of the latter and half the diameter of the orbit.

Color bright yellow, unspotted, except a shade behind the epiclavicle. Caudal fin with a yellow margin and black band within it; anal fin with a dark margin.

Total length .147 m.; to dorsal fin .075; to ventral .065; to anal .088; depth at orbit .028; at first anal ray .073.

From the Marañon between the mouth of the Rio Negro, Brazil, and the Huallaga, Peru. Robert Perkins.

**SILURIDÆ.**

**PSEUDORHAMDIS PISCIBEX**, Cope.

Proceed. Am. Philos. Soc., 1870, 569.

This species presents slight differences in the size of the orbits and relative slenderness of the body, not dependent on age.

1872.]

**PIMELODUS LATERISTRIGA, Müll. Trosch.**

Günth., Catal. v. 118.

Differs somewhat from Günther's description, *i.e.*, in the longer beards and one soft ray less in dorsal and anal fin. Radii D. I. 6, A. 11, V. 6. Maxillary barbels reaching to three-fourths the length of the adipose fin; exterior mentals to end of pectorals.

**DORAS GRYPUS, Cope, sp. nov.**

Lateral shields twenty-eight, short vertically, and furnished with a single strong reverted spine. Tail shielded above and below from opposite the twenty-first. Head broad, flat above, with a short concavity in the position of the fontanelle. Casque broad, obtusely roof-shaped, sending a process back on each side the dorsal fin. Body slender. Pectoral spines very powerful, reaching to beyond dorsal fin (in two specimens), with strong serrations. Dorsal spine strong, longitudinally striate, not serrate. Postclavicular process long and strong, reaching as far as the process of the casque, with an external row of teeth, which are proximally in a groove. Humeral process of coracoid swollen laterally, striate grooved. Top of head rugose. Diameter of eye five times in head (to edge bony operculum), twice in interorbital space, once in muzzle. Preorbital bone with an obtuse vertical ridge. Length of head 3.66 times in length to basis caudal fin, greatest depth 4.2 in same. Radii D. I. 6; C. forked, 15; A. 12; V. reaching to anal 8; P. I. 6. Postcoracoid processes short, smooth, maxillary barbels to middle of pectoral spine.

with three or four serrations near the extremity; three opposite the dorsal fin much elevated, two in front of them small, spineless. Radii D. I. 6; C. + 17 + ; A. 11; V. 7; P. I. 8. Dorsal spine very strong compressed, with teeth pointing downwards behind and upwards before; its length one-half length of fish anterior to it. Pectoral spine flat, striate, with strong teeth on both faces, the posterior the longer. Eye looking partly upwards, covered with rather thick cornea 8.5 times in length to bony opercular margin, a little less than half interorbital width. Muzzle flattened and narrowed, the maxillary beards leading to the middle of the humeral process, the mental beards half as long. Rugosity of the casque striate, bifurcating at the fontanelle, and sending an angle to the front of each orbit, and then ceasing. A weak serration of the small preorbital bone visible. Head flat between the orbits, the casque steeply roof-shaped, contracting and then expanding downwards opposite the dorsal spine, but not exceeding it. Humeral spine extending to opposite dorsal; flat, striate; postcoracoid short, covered with smooth skin. Ventral fin commencing some distance behind last dorsal ray, obtuse, not reaching vent, but reached by the pectoral spine. Caudal peduncle short; caudal fin deeply furcate. Adipose fin well developed, but low. Teeth numerous, brush-like.

Total length .382 m. Length to eye .037; to dorsal spine .12; to ventral fin .165; to anal fin .222; to basis of caudal fin .31. Width at humeral swellings .077; height at basis D. I. .095.

Colors bright; above brownish, sides pink, below white. Fins red, except pectoral and dorsal, which are paler.

This marked species is very different in general physiognomy and details from such short, rough, black species as *D. pectinifrons* and *D. grypus*, being elongate in form, and smooth, though well armed. Discovered by Robert Perkins between the mouth of the Rio Negro and the Huallaga, in the Marañon.

**ZATHORAX**, Cope, gen. nov.

Proc. Acad. N. Sci. Phila., 1871, p. 112.

Branchial fissure much contracted. Lateral shields not meeting on the middle line of the back. No adipose fin? dorsal and anal fins short. Spines and postclavicular process strong. Ventrals behind dorsal. Scapular arch dilated below and covered with a dermo-ossification.

1872.]

This genus is *Doras* with the expanded dermo-ossified sternal shield of the following genus *Physopyxis*. It forms a group connecting the two, and differing from the latter in not having the lateral scuta meeting on the dorsal line. In one specimen there is no adipose fin, in a larger there is a rudiment. As in *Doras*, the postclavicular process is more extensively developed than the postcoracoid, while in *Physopyxis* the latter is developed at the expense of the former. The *Zathorax monitor* constitutes specifically a link between such *Dorades* as *D. grypus* and the *Physopyxis lyra*, in being of stouter form than the former, but less squat and toad-like than the latter. It has the comb-like preorbitals of the latter.

Only one species is known.

**ZATHORAX MONITOR**, Cope, sp. nov.

Twenty-five short lateral scuta, each with one strong recurved median spine. Casque broad, furcate to receive the dorsal fin, obtusely roof-shaped to between the orbits, where it is a little concave, weakly rugulose and striate. Preorbital bones with 12 processes above, not dentate on the lower margin. Muzzle broad, short, lips even, mouth reaching to opposite front of preorbital. Beards on the chin normal. Maxillary barbel reaching to posterior margin of orbit, but possibly further in a harder specimen. Orbit 3.75 times in head, 1.66 in interorbital width; head 3.75 times in length without caudal, twice to third lateral scutum. Greatest depth (at dorsal spine) 3.5 in length. Postclavicular

**PHYSOPYXIS**, Cope.

Proceed. Acad. Nat. Sci. Phila., 1871, 112. Genus novum doradi affine.

Dorsal fin with strong pungent spine, in advance of the ventrals. Gill openings much reduced, opercular apparatus attached to clavicular arch below. No adipose dorsal; anal fin short; vent median; nares close together, the posterior minute. Barbels well developed, one maxillary and two mental on each side. Mouth terminal, teeth minute in several series.

Sides and dorsal part of the body entirely inclosed by vertical osseous shields. Head and thoracic region inclosed in a trihedral osseous box, composed of the expanded cephalic casque above, clavicular arch laterally, and the immense development of the clavicles and coracoids inferiorly. These form a shield, which extends to beneath the eyes anteriorly, and sends two postcoracoida posteriorly, all entirely involving the derm. Pectoral spines and swim-bladder greatly developed.

This strange genus carries to its highest extreme the peculiar features of *Doras*. Thus the branchial fissures are still more reduced, the operculum being attached all along its inferior margin; the lateral osseous dermal scuta are prolonged upwards to the median dorsal line; the pectoral spines are immensely developed. It differs further from *Doras* in the greater development of the inferior elements of the scapular arch and the entire occupation of the skin by the ossification. The swim-bladder is large, and extends to the skin on each side of the casque and above the humeral processes, and between the long postcoracoid processes on the inferior surface. The osseous box inclosing the anterior half of the body protects this swim-bladder, but the teleologist will suggest that perhaps, on the other hand, the large swim-bladder is necessary to float the heavy shields and defensive spines.

The small body and immense casque give this form a very peculiar appearance, and suggest a miniature iron-clad with mast and outriggers.

**PHYSOPYXIS LYRA**, Cope, sp. nov.

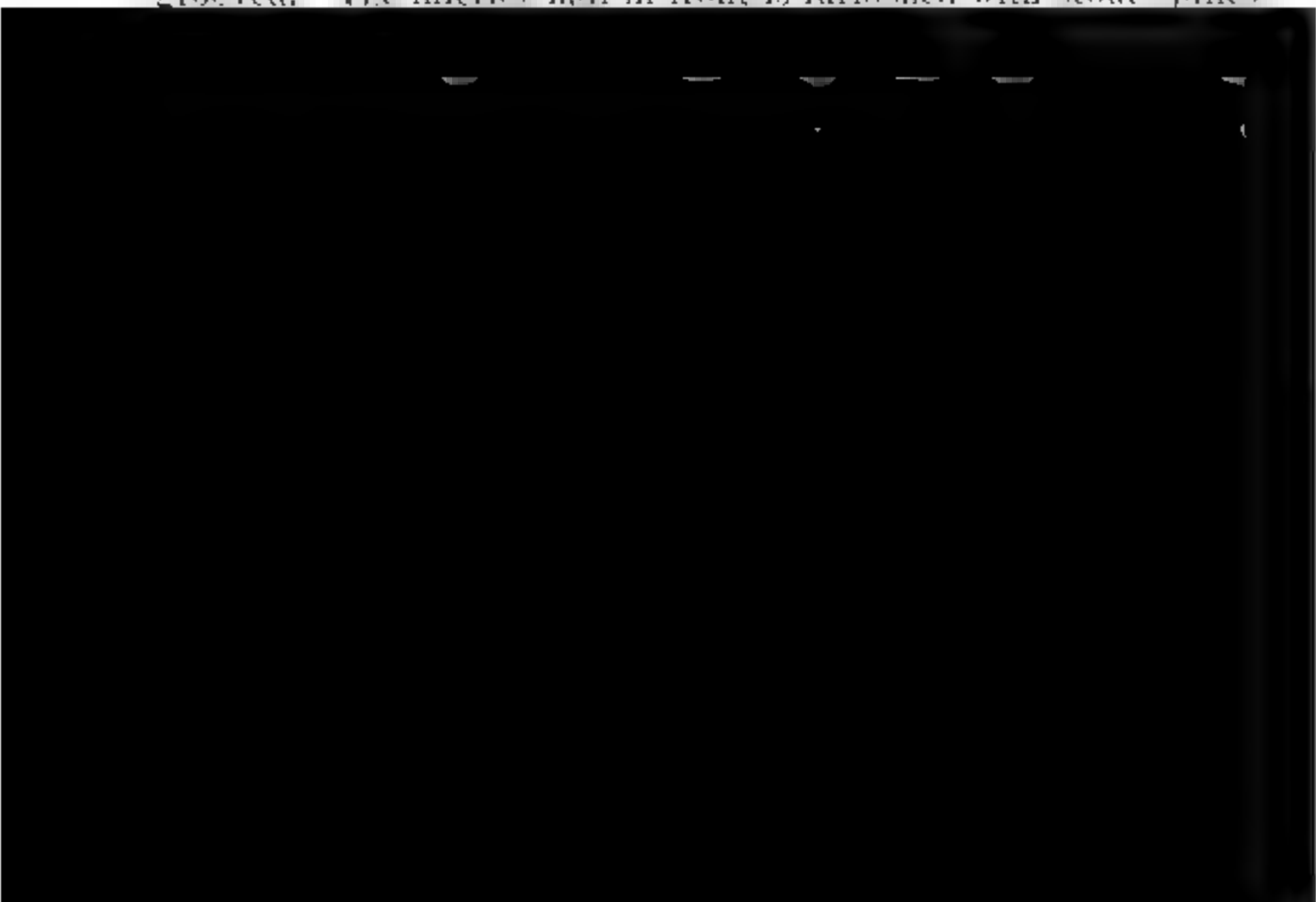
Muzzle short and broadly truncate, about as long as the diameter of the eye, lips even. Interorbital region concave, thrice as wide as the diameter of the orbit, with an oval median fonta-  
1872.]

nelle. Orbit 4.2 times in length to opercular margin. The casque rises from the orbits to the dorsal spine. It is keeled obtusely, or roof-shaped, extends on the sides nearly to the lateral line, and is prolonged into a point on each side of and behind the last ray of the dorsal fin. The humeral portion of the clavicle is much enlarged and dilated horizontally, and is produced into a post-humeral (postclavicular) spine which extends to below the dorsal spine, is sharp-edged, striate, and not serrate.

The inferior aspect of the scapular arch is a transverse shield, convex in front, concave behind, and gently concave inferiorly, two-thirds of its width being composed of the coracoids; the surface punctate. The postcoracoid processes are very long, extending to beyond the bases of the ventral fins; they are curved, and the extremities dilated outwards, so as to present with the thoracic portion exactly the form of the Grecian lyre. The huge prickly pectoral spines curving round on each side, and meeting behind the ventral fins, suggest the wreath which often accompanies the lyre. The surface of the postcoracoid processes is longitudinally striate. A section of the fish in front of the pectoral fins is triangular.

The preorbital bones are well developed; they form an erect transverse crest of eleven long, sharp teeth, and are toothed laterally and below. Casque rugulose.

Radial formula D. I. 4, C. 12, A. 12; V. 6; P. I. 2. The dorsal spine is quite straight, trigonal in section, and longitudinally grooved. The inferior half in front is furnished with stout spines



|   | M.    |
|---|-------|
| Total length . . . . .                    | 0.035 |
| Length to orbit . . . . .                 | .0015 |
| “ “ opercular slit . . . . .              | .007  |
| “ “ ventral fin . . . . .                 | .015  |
| “ “ anal fin . . . . .                    | .0189 |
| “ “ caudal fin . . . . .                  | .028  |
| “ of dorsal spine . . . . .               | .0075 |
| “ “ pectoral spine . . . . .              | .0123 |
| “ “ postcoracoid . . . . .                | .0082 |
| Width of muzzle . . . . .                 | .005  |
| “ at humeral knobs . . . . .              | .013  |
| “ “ 1st lateral shield . . . . .          | .008  |
| Expanse of both pectoral spines . . . . . | .031  |

Ambyiacu River, Equador. John Hauxwell.

The preorbital comb is like that of *Doras pectinifrons*, Cope, from the same region.

**CALLICHTHYS ASPER**, Q. Gaim.

Günther, v. 225.

**CALLICHTHYS MELAMPTERUS**, Cope, sp. nov.

The head depressed, muzzle broadly rounded. Body strongly compressed; the dorsal line rising steeply and continuously with the profile, to the dorsal fin. Caudal region much compressed; tail openly emarginate. Inferior lip little reverted, bearing no barbels; tip of the muzzle projecting but little beyond the mouth. Inferior barbel extending to near the end of the ventral fin, superior to near the end of the pectoral. Lateral shields 25-24, from supraclavicle. Azygous plates 5. Radii D. 8, A. 1, 6, V. 7, P. I. 8. Dorsal spine like other rays, pectoral toothed within, and with short tooth-like bristles without. Spine of adipose reaching to basis of caudal.

Orbit 3.5 times in length of head, twice in interorbital width. Depth of head more than two-thirds length. Length of head one-third length without caudal, equal depth. Length over all, three inches.

Color dark plumbeous; the preorbital region, and caudal and inferior fins, black.

This species is much more compressed than the *C. asper*. Besides other points, there is one more pectoral ray and a different 1872.]

coloration from the *C. knerii*, Gill, from Trinidad, W. I. Numerous specimens.

**DIANEMA**, Cope, gen. nov.

Allied to *Callichthys*. A single barbel at the extremity of each maxillary bone; two barbels at the symphysis of the mandible; teeth minute, brush-like. Body shields in two series, as in *Callichthys*; postcoracoids dilated into two shields which meet on the median line and involve the derm, as in *Hoplosternum*. Sides of the face not shielded; parietal not reaching base of dorsal fin, but separated by two transverse shields of the sides. Dorsal and pectoral fins with powerful spines, caudal subtruncate. Adipose fin present, pungent.

This new genus, it will be seen, combines in an interesting manner the characters of *Hoplosternum*, Gill, *Brochis*, Cope, and *Corydoras*, Lac. The shielding is of the first, and the fin radii of the last two, while in the peculiar barbels it resembles no other. The relation of these to the double maxillary barbels of *Corydoras* appears to be explained by the structure in the genus *Brochis*, and will be mentioned under that head.

**DIANEMA LONGIBARBIS**, Cope.

Form rounded compressed; head depressed, wide, but abruptly narrowed in front of the nares. Maxillary barbels not reaching the opercular margin, mental to the middle of the pectoral fins. Shields 25-24, azygos four, all nearly smooth. Radii D. I. 7 L;

**BROCHIS**, Cope, gen. nov..

Allied to the last genus. Two barbels at the extremity of the maxillary bone, united by a beard-like looped cord to the symphysis mandibuli, the cord being thus attached at both ends. Teeth rudimental or wanting. Body with two longitudinal series of shields, the postcoracoids expanded and meeting on the median line. Head compressed, the parietal shield only separated from the dorsal spine by the basal azygos shield of the latter. Sides of head shielded to the mandibles. Dorsal and pectoral fins with strong spines; adipose present, purgent. Caudal fin emarginate.

This genus is allied to *Corydoras*, but differs from it as *Hoplosternum* does from *Callichthys* with the addition of the peculiar pendent dermal loops of the mandible. These loops are confluent at the symphysis mandibuli, and from that point to their union with the maxillary barbels resemble exactly the mental barbels of *Dianema*. It is difficult to avoid believing that these loops are homologically the recurved inferior lips of *Corydoras*, separated from the greater part of the ramus, but joining again at the canthus of the mouth and giving rise to the inferior barbel. It then follows with much probability that this connection also is severed in *Dianema*, and the inferior maxillary barbel remaining as before continuous with the mandibular loop, becomes the mental barbel. In the shielding of the head, *Brochis* is like *Corydoras*, while *Dianema* is like *Hoplosternum*, so that the affinities are complicated and not readily expressed by a linear arrangement.

**BROCHIS COERULEUS**, Cope, sp. nov.

Form short, stout, elevated, and compressed. Head steep, gently convex above the orbits and concave above and below them, and tapering to a very narrow muzzle, which overhangs the mouth a little. Scuta, 23-21, smooth, with one oval supratemporal shield only. Nares small, close to the orbits. One large combined pre- and suborbital shield; a large subtriangular loreal plate. Maxillary barbels extending to opposite the middle of the orbit. Shields of the head, with the postcoracoids, slightly rugose.

Length of head one-third length without caudal fin, 1.33 times in greatest depth at basis of dorsal. Orbit four times in head, more than twice in muzzle, which equals the width of the convex interorbital space. The dorsal outline is strongly arched, de-  
1872.]

scending behind from the middle of the dorsal fin. Raddi D. I. 11, I., without adipose portion; C. 14; A. 8; V. short, 6; P. I. 9. Dorsal spine moderate, serrate behind and smooth before, pectoral stronger, finely but strongly serrate behind, smooth in front; it extends to or a little beyond the middle of the ventral in all our specimens. Length, three inches; depth, one inch.

Color of body and sides above, with sides of head, metallic blue; below, yellowish. Fins unspotted.

This elegant species appears to be very common in the tributaries of the Ambyacu.

**BROCHIS DIPTERUS**, Cope, sp. nov.

This species is represented by a single specimen, which differs in several points from the type of the genus. These are: 1st, the existence of a well-developed adipose membrane to the adipose fin; 2d, the existence of only ten rays in the first dorsal fin; 3d, the thick attached inferior lip with two median beards. The lateral shield of the muzzle is more completely united with the surface of the ethmoid than in similar specimens of the *B. coeruleus*, but not more so than in larger specimens. Scuta 24 above. Pectoral and dorsal spines serrate within. Color and proportions as in *B. coeruleus*, the added adipose fin having a black border behind.

The characters of seven specimens of the type species are constantly different from this one.

gion, and of the sides of the muzzle, these regions being inclosed by membrane only.

One species, *C. semiscutatus*, Cope, has the postcoracoid processes much widened and with a superficial rugose ossification of the derm, thus approaching *Brochis*. The median portion of the thorax is, however, not inclosed. The sides of the head are also more fully ossified than in other species.

The typical species present interesting modifications of the inferior lips. Thus, that of *C. ambiacus* is broadly reflexed, of equal thickness, and furnished on its posterior border with two short barbels. In *C. trilineatus* the lip is recurved, and without barbels, but the margin is thickened into a cord, which is connected with the edge of the mandible by a membrane so attenuated as to be easily ruptured, when the arrangement resembles closely that seen in *Brochis*. In the third group the inferior lip appears to be entirely wanting. I add to the characters of the four new species here described those of the three recorded by Günther, as far as I can learn them.

#### GROUP I.

Head longer than high ; barbels to middle of orbit ; "A. 6."

C. PALEATUS.

Head higher than long ; barbels to operculum ; A. I. 6. Muzzle long ; dorsal spine moderate serrate ; irregularly spotted. C. AMBIACUS.

#### GROUP II.

Muzzle short, convex ; barbel to posterior edge of orbit ; dorsal and anal spines shorter, former smooth ; a light lateral band, divided and margined by a black line.

C. TRILINEATUS.

#### GROUP III.

Muzzle produced, acute, concave ; barbel to middle of orbit ; dorsal and anal spines short, former serrate ; no azygus shields ; uniform, with a pale lateral band.

C. ACUTUS.

Muzzle short, acute, concave ; barbels to middle of orbit ; dorsal and anal spines very long, former smooth ; four azygus shields ; olive, black-dotted.

C. AMPHIBELUS.

#### GROUP ? ?

"Head high as long ; barbels to gill opening ; A. 8." C. PUNCTATUS.

"Similar to *C. paleatus*, but fins immaculate ; A. I. 6." C. AENEUS.

"Head higher than long, muzzle short convex ; barbels to below eye ; dorsal spine long, serrate ; anal short, four or five azygus plates ; anterior scutes with vertical rows of black spots."

C. ARMATUS.

1872.]

**CORYDORAS SEMISCUTATUS, Cope, sp. nov.**

Radii D. I. 11, I., no adipose portion; A. I. 6; V. 6; P. I. 10. Scuta 23 above, including postcephalic, no azygus shields. Pre-orbital bone and shield single, large, extending half way from orbit to maxillary, and downwards, .4 way to line of mandible. Postcoracoid processes wide, with convex inner margins which are separated by a wide fissure, the surface striate rugose, no lateral shield separates them from the base of the ventral fins.

Profile steep, arched in front of nares; muzzle contracted, pointed. Orbit 3.5 times in head, 1.66 times in muzzle and inter-orbital space. Head 2.8 in length without caudal fin; depth 2.4 times in same. Inferior lip beaded on margin, which easily separates, forming a loop; no median barbels visible.

General color above pearly or nacreous-blue, with metallic reflections on postclavicle and operculum.

This species shows a marked tendency to the genus *Brochis* in the increased extent of the osseous shields of the thorax and sides of the head. The enlarged number of dorsal fin rays is another indication of such affinity. It represents very closely, I have no doubt, a young stage of *Brochis caeruleus* in the incompleteness of the shield development, and might, by some, be regarded as that animal itself. Specimens of the latter of nearly the same size betray no approach to it in characters, and experience elsewhere warrants the opinion that the parallelism will be seen at a far younger age than any of our specimens represent.

Radii D. I. 7. A. I. 6; V. 6; P. I. 9, the spine acute, serrate on inner side, reaching half-way along ventral. Anal spine short, weaker than adipose dorsal spine. Latter with adipose appendage.

Straw color, with numerous indefinite brown spots on the sides. Dorsal fin with a large black spot covering anterior half, which also expands on the dorsal region round the base of the fin. Four vertical brown bands on caudal fin; anal spotted. Cheeks with blue reflections. Length .058 m.; depth at D. I. .018 m.

**CORYDORAS TRILINEATUS**, Cope, sp. nov.

This species is easily distinguished from the other species here noticed, by the short, abruptly decurved muzzle, and three longitudinal lateral lines.

The head is much deeper than long, and enters the length without caudal fin 3.5 times, and the greatest depth 1.5 times. Orbit 2.75 in head, 1.5 in convex interorbital space. Lateral shields 21-20; two highly keeled azygus. Radii D. I. 7; A. I. 6; V. 6; P. I. 6, the spine acute, without serrations; the dorsal spine serrate throughout behind, not extending to the base of the adipose spine. Latter much larger than anal spine, attached to an adipose portion.

Light straw-colored, brownish above, a yellowish lateral band with rather faint brown margin above and below, and blackish median line. A very black spot on *the ends* of the soft dorsal rays; tail deeply forked, with five vertical bands; anal spotted. Some longitudinal lines on the side of the face. Length .049 m., depth .015 m.

The mouth in this species is quite inferior. The peculiar structure of the lower lip, which is a festoon supported by a thin membrane, I have verified on two individuals. The thick margin on each side bears a very short barbel.

**CORYDORAS ACUTUS**, Cope, sp. nov.

A stout species, differing from the others, especially in the attenuation of the muzzle, which viewed from above is narrow, and contracted abruptly from the general outline. Mouth inferior, lower lip wanting or not reverted. Head 3.1 times in length without caudal, 1.33 times in depth. Orbit three times in head, 1.33 times in the nearly flat interorbital space. Lateral scuta 22-21; no azygus plates. Radii D. I. 7; A. I. 6; V. 6; P. I. 5, the 1872.]

spines serrate on the inner side. Dorsal spine serrate posteriorly on the distal half. Adipose spine without fin, stouter than anal spine. Caudal fin furcate.

Color olive (faded), a faint pale band on each side; a large black spot on distal part of dorsal rays. Caudal with four vertical bars; clavicle and operculum with blue reflections. Length .051 m., depth .0155 m.

**CORYDORAS AMPHIBELUS**, Cope, sp. nov.

A species much like the last, but differing in its longer spines, short muzzle, and numerous azygus shields, etc. Form the stoutest in the genus, profile descending steeply from the dorsal fin to below the nares, then concave, and descending to the narrow muzzle. Head three times in length lacking caudal, 1.4 times in depth. Orbit 3 times in head, 1.6 times in interorbital width. Lateral shields 21-19, four flat azygus. Radii D. I. 7; A. I. 6; V. 6; P. I. 6, the spine serrate within. Dorsal spine serrate posteriorly, elongate, reaching the adipose spine when depressed. Adipose long without fin, but shorter than the slender spine of the anal. Total length .037 m.; depth .0124 m.

Color light olive, face with blue reflections. Numerous small black dots on the side shields, which are only wanting on the middle line of the side. Dorsal with a black spot on the ends of its radii, and another at the base of its spine. Caudal with four vertical cross-bars.

**CORYDORAS PUNCTATUS** Bloch



**CORYDORAS SPLENDENS**, Cast.

*Callichthys splendens*, Castelnau, Anim. Nouv. Rar. Am. Sud. 89, Tab. 18, f. 8.

Rio Tocantins.

**OTOCINCLUS**, Cope.

Proc. Acad. Nat. Sci., Phila., 1871, p. 112.

Subfamily *Hypostomatina* of Günther's system. Ventral fins immediately below the front of the short dorsal; branchial fissures extending a little below pectoral fins. Vent a little behind the middle of the body. Body shielded with several series of plates, the anterior less numerous. Thoracic and abdominal regions with numerous shields. No adipose fin; dorsal with weak, pectoral with strong spine. Inter-operculum horizontal, beneath the orbit, unarmed. No barbels. The teeth as in allied genera. Post-temporal region pierced with numerous foramina, forming a sieve, which only separates the water from a large cavity on each side of the modified anterior vertebræ, by the thin skin which covers it.

This genus is allied to *Hypoptopoma*, and apparently to *Rhinelepis*. The arrangement of the opercular bones is like that seen in the former (see figure of *H. bilobatum* in Proc. Am. Phil. Soc., 1870, p. 567), while the absence of adipose fin and general rugosity are seen in the latter. Neither exhibits the remarkable perforation of the post-temporal plate. This is, in the only known species, so extensive as to cover the whole plate to the orbit, which becomes thus a skeleton sieve of some beauty, through which the cavity within may be plainly seen. Its use is unknown, but may be connected with the function of hearing, as the genus has no swim-bladder.

**OTOCINCLUS VESTITUS**, Cope, sp. nov.

Body compressed, head elongate oval, neither elevated. Muzzle rounded-acuminate, projecting much beyond mouth, nareal opening near orbit. Loreal region vertical, a canthus rostralis; muzzle a little convex between nares and orbits; profile gently arched from dorsal fin to end of muzzle. Scales obtusely angulate behind, the exposed surface covered with distant elongate prickles. Four rows on the caudal peduncle, the third from above bearing some tubes of the lateral line, and becoming more elongate and oblique anteriorly, until from the point of the pectoral 1872.]

they occupy the entire inferior half of the side. The second does not enlarge till near the postcephalic plates, where two or three occupy the upper half of the side. Longitudinal line containing twenty-one. Those of the superior and inferior series are angulate near the margin of the peduncle, and meet on the superior and inferior median lines by a straight suture. Thus these faces form distinct but slightly convex, narrow planes. Parietal shield broader than long, postparietal large, its apex separated from D. I. by two cross-shields, the first wider. A large shield on each side the postparietal. The whole of this region swollen, greatest width of head at the sieve.

Orbit three times in head, twice in interorbital width; head 3.5 times in length, without caudal fin; depth 4.5 times in same. Caudal fin well developed, deeply forked. Dorsal elevated in front; radii I. 6; C. 17; A. I. 5; V. I. 5; P. I. 5; the spine flat, reaching the basal fourth of the ventrals, with short spines outside which become teeth at the end; within smooth. Scapular arch rather narrow below, followed by three series of shields, of which the lateral are long and narrow. These gradually diverge and admit three series of small scales, which again diminish and terminate in an obtuse point between the ventral fins. This leaves with the ends of the lateral shields a Y-shaped naked space, at the end of which is situated the vent. These are covered with numerous short bristles, like the scales of the dorsal region. The head, especially the muzzle, and more particularly the sides of the latter, are covered with many short, closely set, spiny bristles,

than inferior. Scuta l. l. 28, l. tr. 4. Inferior regions granular; dermo-ossification of head extending to inferior plane all around, Orbit small, three times in interorbital width, five times in head, width a little greater than length. A marked canthus rostralis to beyond nares; loreal region steep, concave. An occipital keel, nuchal shields two-keeled. Elevation at latter, equal length muzzle and orbit.

Scales rugose, with a serrate median keel ending in a point.

Above, brown; below, yellowish-brown, closely spotted with dark brown, most coarsely on the belly, and finely on the head, leaving vermicular interspaces; eight rows of black spots on the dorsal fin. Other fins, except the caudal, closely black-spotted.

Length .18 m.; to anal fin .085; to mandible .01.

Numerous young specimens of this species, the largest .085 m. in length, display the following characters of immaturity. The inferior surfaces are smooth, and in the smaller the dermo-ossification of the loreal region exists only in spots, and in still smaller is wanting.

Two large specimens from Perkin's expedition have the humeral width and the total length, the base of the dorsal fin enters the same 3.75 times, and is equal the length of the pectoral spine, and the greatest depth of the body enters six times. The specimens agree with Castelnau's *L. pardalis* in having dorsal radii 1.12, but differ in having no keel on each side of the back posterior to the dorsal fin, and in having large spots on the belly, not "punctæ." The former character I derive from Castelnau's figure only.

The young of a second species of this genus occurs in the collection.

**PLECOSTOMUS BISERIATUS**, Cope, sp. nov.

Radii D. I. 7; A. 5; V. I. 5; P. I. 6. Lateral series of scuta 28, three rows between ventral and dorsal fins. Elevation of first dorsal ray equal length of head; length of basis equal to distance from spine of adipose, and 1.66 times length of head and nape. Scuta between dorsals 8, between anal and caudal 16. Pectoral spine to basis of ventral. Scuta not carinate, coarsely striate, the striæ terminating in a few small spines.

Head short, entering length without caudal fin 4.5 times, and a little less than width. A postorbital and orbito-nareal angle, rim of orbit elevated above front. An obtuse median occipital

1872.]

elevation, nuchal scuta not keeled. Orbits four times in head, 2.5 times in interorbital space. Muzzle regularly acuminate, a triangular spot on extremity, smooth. Margins of muzzle not spinous. Inferior surfaces rugose, except a smooth band surrounding posterior lip, and a quadrate area within ventral fin. Lip entire; barbels short.

Inferior caudal ray one-quarter longer than superior, no long bristles on it or the ventral.

Total length 1.55 m.; do. to dorsal fin .045; to anal ; humeral width .07. Color yellow; below white, immaculate. Above with three rows of ill-defined blackish spots at the unions of scales, the inferior wanting behind the line of the dorsal fin. Head above with many close brown dots. Dorsal fin with two rows of blackish spots between each pair of rays; one series between the caudals. Twenty-eight teeth on each ramus mandibuli.

From the Amazon, from Robert C. Perkins. This species is especially distinguished by its short head, and by the characters of squamation of lower surface, color, etc.

**PLECOSTOMUS SCOPIULARIUS**, Cope, *sp. nov.*

Proc. Acad. Nat. Sci., Phila., 1871, p. 55.

Is represented by a number of similar young individuals. They differ in having a more slender muzzle, and dorsal radii II. 12, I. Ventrals also I. 5.

**CHLÆTOSTOMUS**, Tsch. Heckel.

Eye 2.33 times in front; head short, contracted at the front, four times in length; canthus rostralis vertical concave; brown, with many large oval pale spots above only. *C. VARIOLUS.*

III. Unossified margin of muzzle exceedingly narrow, no tentacles, D. I. 7. Head short, broad, 4.25 times in length; eye 2.66 in front. Black, below brown; small. *C. SERICEUS.*

The smallest of these species, it will be observed, has the most complete dermo-ossification, and the largest the least. The next largest species, *C. tectirostris*, is next most fully ossified, while the *C. malacops*, with but little ossification, is after *C. sericeus*, and *C. variolus* the smallest. So there is no relation between the ossification and the size.

It may be observed that these species all agree in many points not above mentioned, viz.: Anal radii V.; V. I. 5; P. I. 6; and in having the inferior lobe of the caudal longer than the superior. Thorax and belly naked; lateral lines 23-4.

**CHÆTOSTOMUS ALGA**, Cope, sp. nov.

Width of head 3.33 times in length without caudal. Preopercular spines thirteen, of which two posterior are longer, and extend a little beyond the line of the orbit. Muzzle with numerous tentacles on the margin and sides, and a V-shaped series above of larger size, the largest in front at the apex of the V. Dorsal spine a little longer than base of fin, one-half length; pectoral spine extending to basal third or two-fifths of ventral spine. Scuta with ten serrate subequal ridges, each terminating in a spine. The ossification of the derm forms only a narrow band in front of nares and orbit.

Total length .165 m. I associate with this species a second specimen, which agrees in every respect except in wanting tentacles. This is probably, as Günther states of *C. cirrhosus*, the female.

This species is apparently near the latter species, but has a shorter body.

**CHÆTOSTOMUS MALACOPS**, Cope, sp. nov.

The lores are naked to near the nares, but the ossification extends in an angle to the middle of the muzzle. Width of head

3.4 in total without caudal. Ten principal bristles, the longest not extending to hinder margin of orbit. Dorsal spine longer, 1.5 times in length anterior to it; pectoral reaching beyond base of ventrals. Ten plates from anal to caudal, five between dorsals. Color brown, with many closely placed yellow spots. Length .097 m. With the last; two specimens.

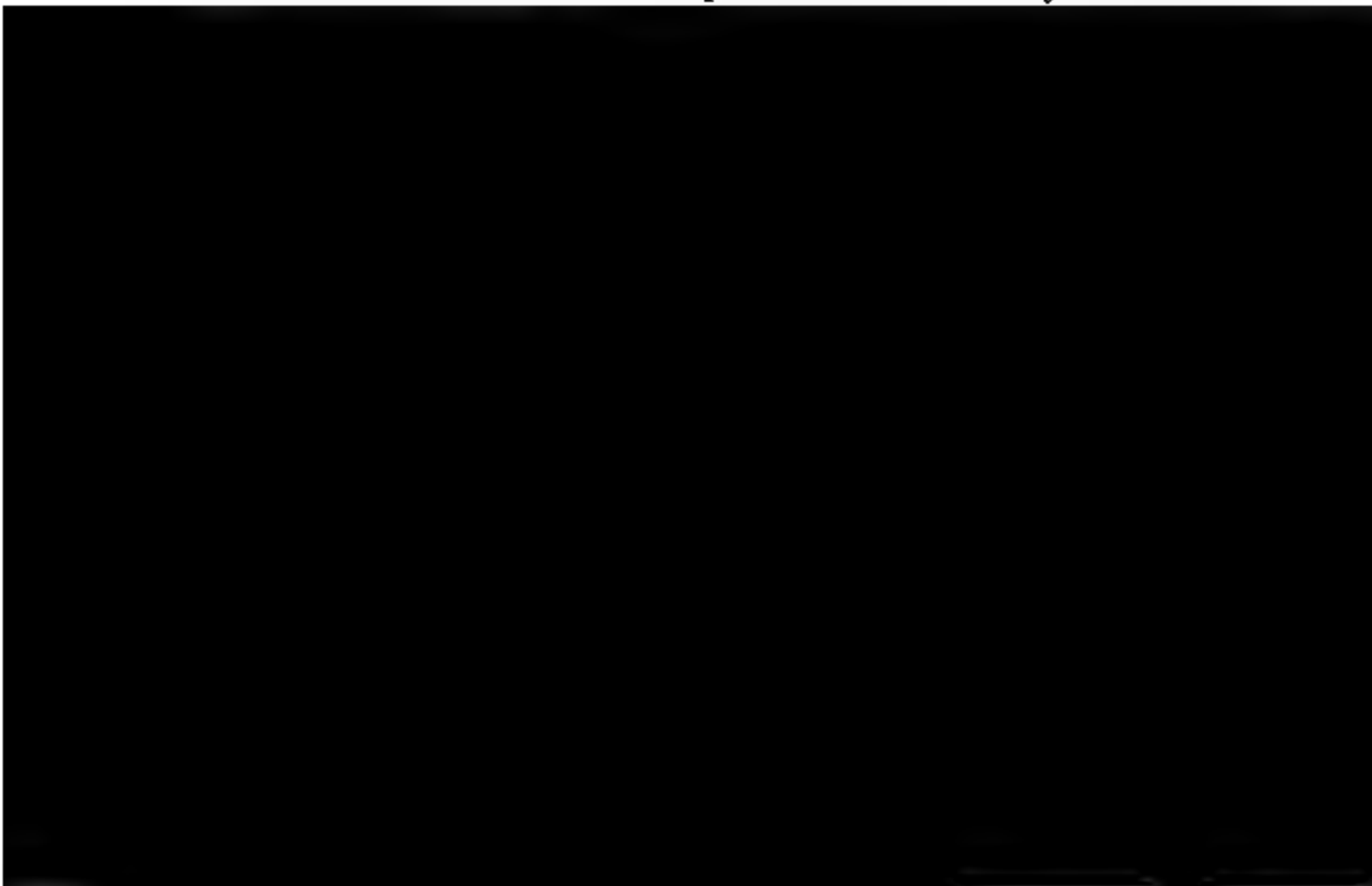
**CHÆTOSTOMUS VARIOLUS**, Cope, sp. nov.

This species has a much narrower unossified labial margin than the last, the muzzle being entirely covered above to near the lip. Thirteen principal opercular spines which do not extend beyond the line of the orbit; three of them longer and subequal. Loreal region vertical. Scuta between dorsals 6, between anal and caudal 10. Dorsal spine 1.5 times length from its base to muzzle. Pectoral spine a little beyond base of ventral. Ridges of scuta represented by rows of bristles, which give them a hoary appearance. No keels.

Length .068 m. Color bright brown, with numerous large round yellow spots; belly unspotted. With the last.

**CHÆTOSTOMUS TECTIROSTRIS**, Cope, sp. nov.

Naked labial band as wide as space between nares and orbit. Only eleven preopercular spines, of which two posterior are subequal, longer, and reaching a little beyond line of orbit. Loreal region oblique, nearly plane. Dorsal spine 1.66 times in length in advance of it. Pectoral spines to a little beyond ventral.



rim of orbit. Dorsal spine 1.5 times in length in front of its base; pectoral scarcely beyond base of ventral. The ridges of other species are represented by rows of bristles. No ridges on the head. Color black, unspotted, or in a smaller specimen with faint pale spots above. Length .067 m. Two specimens with the preceding.

This species and the *C. malacops* might have been regarded as the young of *C. tectirostris* and *C. alga*, respectively, were it not that the larger individuals possess the characters of immaturity exhibited by other animals, viz., larger head, and less ossification of the derm of the muzzle.

**LORICARIA ACUTA**, Cuv. Val.

XV. 472; Gthr., Catal. B. M. v. 258.

From the Ambyiacu.

**PARIOLIUS**, Cope, gen. nov.

Allied to *Trichomycterus*. Ventral fins present, anterior to the short dorsal. Anal fin short; vent situated beneath the dorsal fin; no adipose fin. No nasal barbel, one maxillary and two lateral mentals. No armature on any of the opercular bones. Teeth in brush-like series.

This genus is allied to *Trichomycterus* in the extensive branchial fissures and other characters, but differs in the absence of armature of the head, and number and position of tentacles.

**PARIOLIUS ARMILLATUS**, Cope, sp. nov.

Head flat rounded, eyes small, superior, covered by the skin. Head 4.5 times in length to basis of caudal fin. Depth at D. I. one-half length to basis pectoral fin; width of head two-thirds the same distance. Interorbital width 3.66 times in length of head. Maxillary and external mental barbels extending beyond basis of pectoral; inner mental barbel on half the same. Radii D. 7; P. 8; V. 6; A. 11; caudal acuminate. Skin entirely smooth.

Color dark-brown, nearly black on the top of the head; under surfaces from anus brownish-yellow, brown punctulate. A broad yellow collar extends from the under surface on each side across the bases of the pectoral fins and the vertex. A vertical dark spot on base of caudal; fins brown-spotted.

1872.]

|                                    | M.    |
|------------------------------------|-------|
| Total length . . . . .             | 0.041 |
| Length to opercular edge . . . . . | .0078 |
| "    pectoral fin . . . . .        | .006  |
| "    dorsal . . . . .              | .0158 |
| "    anal . . . . .                | .0246 |
| "    caudal . . . . .              | .033  |

From the Ambyiacu, Jno. Hauxwell.

#### PARIODON MICROPS, Kner.

Sitzungsab. Wien. Acad., 1855, p. 161. Günther, Catal. B. Mus. v. 275.

A fine specimen of this fish was obtained by Robert Perkins. It is nearly allied to *Stegophilus* Rhdt., and belongs to the *Stegophilina* of Günther. The latter author, however, places it in his *Trichomycterina*, a step calculated to mislead the student, as it contradicts its natural characters. Günther does not appear to have seen the fish, and perhaps Kner omits mention of the characters necessary to decide the question. It possesses the very posterior vent, and the gill covers united with the throat found by Günther to define the *Stegophilina*.

### SYMBRANCHIDÆ

#### SYMBRANCHUS MARMORATUS, Bl.

The color of the fish is as far as made known by the spec-

|              | Gen. | Species. |
|--------------|------|----------|
| CHROMIDIDÆ,  | 0    | 9        |
| ERYTHINIDÆ,  | 0    | 1        |
| CHARACINIDÆ, | 3    | 16       |
| SILURIDÆ,    | 6    | 20       |

The general character of this list is that of any other part of the Amazon basin, presenting peculiarities in peculiar species and in genera not found in the lower Amazon. Such genera among Characindæ are *Triportheus*, *Megalobrycon*, *Aphyocharax*, *Iguanodectes*, and *Stethaprion*; among Siluridæ, *Dianema*, *Brochis*, *Zathorax*, *Physopyxis*, *Otocinclus*, and *Pariolius*. A genus (*Characidium*) previously only known by one small species from a Brazilian coast stream, has its range greatly extended by the discovery of a species in the Ambyiacu.

The species contained in the Perkins collection are as follows:—

#### CHROMIDIDÆ.

PTEROPHYLLUM SCALARE, C. V.

SYMPHYSODON DISCUS, Heck.

CICHLA OCELLARIS, Bl. Schn.

GEOPHAGUS PROXIMUS, Cast. Radii D. XVII–XVIII–11; A. III–8. Scales 6–34–12, upper and lower halves caudal fin scaly to near end.

HYGROGONUS OCELLATUS, Agass.

#### SCIAENIDÆ.

One species.

#### PLEURONECTIDÆ.

One species.

#### OSTEOGLOSSIDÆ.

OSTEOGLOSSUM BICIRRHOSUM, Vand.

#### CHARACINIDÆ.

CURIMATUS CYPRINOIDES, L.

HEMIODUS MICROLEPIS, Kner.

TETRAGONOPTERUS CHALCEUS, Artedi.

MYLETES ALBISCOPUS, Cope.

MYLETES BIDENS, Spix.

MYLETES, sp. nov.

1872.]

SERRASALMO ÆSOPUS, Cope.  
SERRASALMO HUMERALIS, Kner.  
SERRASALMO NATTERERI, Kner.  
HYDROLICUS SCOMBEROIDES, Spix.  
REBOIDES RUBRIVERTEX, Cope.

SILURIDÆ.

CETOPSIS OECUTIENS, Licht.  
PARIODON MICROPS, Kner.  
PIRAMUTANA, sp. nov.  
CALLOPHYSUS LATERALIS, Gill.  
PHRACTOCEPHALUS HEMILIOPTERUS, Bl. Schn.  
RHINODORAS NIGER, Valenci.  
DORAS BRACHIATUS, Cope.  
PLECOSTOMUS SCOPULARIUS, Cope.  
PLECOSTOMUS BISERIATUS, Cope.  
LIPOSARCUS VARIUS, Cope.

## EXPLANATION OF THE PLATES.

## PLATE III.

Fig. 1. *Doras pectinifrons* Cope.

## PLATE IV.

Fig. 1. *Zathorax monitor* Cope ; *b* from below ; *c* from front.

" 2. *Otocinclus vestitus* Cope ; *b* from above ; *c* head, side view.

## PLATE V.

Fig. 1. *Physopyxis lyra* Cope ; *b* from below ; *c* from front.

" 2. *Chaetostomus malucops* Cope ; *b* from below.

## PLATE VI.

Fig. 1. *Corydoras semiscutatus* Cope ; *b* from below.

" 2. *Corydoras trilincatus* Cope ; *b* from above ; *c* from below.

## PLATE VII.

Fig. 1. *Dianema longibarbis* Cope ; *a* from above ; *b* from below.

" 2. *Brochis coeruleus* Cope ; *a* from above ; *b* from below.

## PLATE VIII.

Fig. 1. *Iguanodectes tenuis* Cope (adipose fin omitted by artist) ; 1*a* dentition.

" 2. *Characidium etheostoma* Cope ; dentition.

" 3. *Triportheus albus* Cope ; dentition.

## PLATE IX.

Fig. 1. *Anacyrtus sanguineus* Cope.

" 2. *Serrasalmo iridopsis* Cope.

" 3. *Brochis coeruleus* Cope.

## PLATE X.

Fig. 1. *Crenicichla anthurus* Cope.

" 2. *Megalobrycon erythropterus* Cope.

## PLATE XI.

Fig. 1. *Geophagus badiipinnis* Cope.

" 2. *Uarus centrarchoides* Cope.

" 3. *Acara syspilus* Cope.

" 4. *Acara flavilabris* Cope.

1872.]

PART III.—20

## PLATE XII.

- Fig. 1. *Myletes albiscopus* Cope.  
" 2. *Myletes oculus* Cope.  
" 3. *Myletes herniarius* Cope.

## PLATE XIII.

- Fig. 1. *Megalobrycon melanopterus* Cope.  
" 2. *Xiphostoma todo* Cope.  
" 3. *Ocharacidium theostoma* Cope.

## PLATE XIV.

- Fig. 1. *Triportheus flavus* Cope.  
" 2. *Triportheus albus* Cope.  
" 3. *Chalcinus culter* Cope.  
" 4. *Callichthys melampurus* Cope.  
" 5. The same; head from above.

## PLATE XV.

- Fig. 1. *Doras grypus* Cope.  
" 1a. Do. from below.  
" 2. *Chatostomus tectirostris* Cope.  
" 3. *Chatostomus alga* Cope, from above.

## PLATE XVI.

- Fig. 1. *Plecostomus scopularius* Cope; one-fourth natural size.  
" 2. Same from below.

## PLATE XVII.



## NOVEMBER 7.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-four members present.

The death of Wilhelm Ritter von Haidinger, a correspondent of the Academy, was announced.

Prof. COPE exhibited a specimen of a *Galeodes*, probably *G. pallipes* of Say, taken in the town of Denver, Colorado, by Dr. Gehrung. According to that gentleman, it was common in that place in houses, and was an enemy and destroyer of the *Cimex lectularius* (bedbug). In captivity, it showed a preference for them as food, and crushed them in its short cheles, preliminary to sucking their juices.

Mr. THOMAS MEEHAN said that while travelling through a wood recently he was struck in the face by some seeds of *Hamamelis virginica*, the common Witch Hazel, with as much force as if they were spent shot from a gun. Not aware before that these capsules possessed any projecting power, he gathered a quantity in order to ascertain the cause of the projecting force, and the measure of its power. Laying the capsules on the floor, he found the seeds were thrown generally four or six feet, and in one instance as much as twelve feet away. The cause of this immense projecting power he found to be simply in the contraction of the horny albumen which surrounded the seed. The seeds were oval, and in a smooth bony envelope, and when the albumen had burst and expanded enough to get just beyond the middle where the seed narrowed again, the contraction of the albumen caused the seed to slip out with force, just as we would squeeze out a smooth tapering stone between the finger and thumb.

---

NOVEMBER 21.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-six members present.

The following paper was presented for publication :—

“Notes on Feldspars and some other Minerals of Philadelphia and vicinity.” By Theo. D. Rand.

Mr. THOMAS MEEHAN said that of all the problems that faced the botanist, few seemed more impenetrable than the law which governed the angular divergence in the branches of plants. Some 1872.]

grew quite prostrate, and others, though closely allied species, might be strictly erect. At the present season of the year we may note plants with prostrate leaves or branches, which in spring will have them of a sharp, upright angle. The verbascums at the present time, especially *V. blattaria*, had their root leaves so firmly pressed against the ground, that on lifting they would fall back with a spring; as soon as the central axis grew, the leaves from that would be almost upright. In some respects, erection or prostration became almost specific characters. The *Rubus villosus* usually grew erect even from infancy, and the *Rubus canadensis* generally trailed; yet the last-named would sometimes throw up strong erect stems, which could scarcely be distinguished in that stage from *R. villosus*. Again, the same species of tree would often produce individuals quite erect, and at other times very pendent, and hence we had in Horticulture the class of weeping trees. All trees seemed to have this power of producing pendent individuals. The oaks, ashes, poplars, elms, all furnished familiar examples.

It was usual with botanists to pass these things over as "weaknesses." But the term weakness explained nothing. To say that these plants had lost the power of erection, was simply restating the primary fact. Moreover, some of these prostrate forms had apparently more vigor than the erect ones. *Rubus canadensis* was weaker than *R. villosus*, truly; but, on the other hand, some of the Russian trailing junipers were far more vigorous than any of the upright forms. The weeping beech also was in appearance more vigorous than the ordinary forms. All beeches had their young growth pendent. As the growth matured, the branches became erect; but in the weeping form erection did not come with maturity, and hence it remained pendent. In the ashes, however, there was no pendency in the young growth; but the "weeping ash" was one of the most decedent of all decedent trees.

*Flies as a Means of Communicating Contagious Diseases.*—Prof. LEIDY remarked that at this time, during the prevalence of smallpox, he was reminded of an opinion he had entertained that flies were probably a means of communicating contagious disease to a greater degree than was generally suspected. From what he had observed in one of the large military hospitals, in which hospital gangrene had existed, during the late rebellion, he thought flies should be carefully excluded from wounds. Recently he noticed some flies greedily sipping the diffuent matter of some fungi of the *Phallus impudicus*. He caught several, and found that on holding them by the wings they would exude two or three drops of liquid from the proboscis, which, examined by the microscope, were found to swarm with the spores of the fungus. The stomach was likewise filled with the same liquid, swarming with spores.

---

NOVEMBER 28.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-three members present.

The deaths of Rev. E. E. Adams and Gen. F. F. Cavada, correspondents of the Academy, were announced.

Prof. COPE made some remarks on the fauna of the Wyandotte Cave in Southern Indiana. He stated that the blind fish of the Mammoth Cave (*Amblyopsis spelæus*) was not rare in waters flowing from it, and that an *Astacus*, probably *A. pellucidus* also occurred. He had detected two species of *Anophthalmus*, both of which were new, according to Dr. Horn; and three *Staphylinidæ*, two of which were to be described by Dr. Horn. A cricket of the genus *Raphidophora*, and two species of flies, were also common. There were two species of spiders, one a true *Aranean*, the other allied to *Opilio*. A centipede allied to *Pseudotremia* was very abundant. A curious aquatic crustacean with external egg-pouches was found in an old trough. The most remarkable animal is a crustacean of the Lernæan division, found parasitic on the upper lip of the *Amblyopsis*. It had an elongate cephalothorax, oval abdomen separated by a constriction, not distinctly segmented, and with short egg-pouches. The anterior limbs modified into a single strong peduncle. The form appeared to be allied to *Achtheres*, but the single undivided peduncle distinguished it generically. He called it *Cauloxenus stygius*.

Prof. Cope exhibited a number of specimens of fossil reptiles recently procured by him in Western Kansas, in the Cretaceous Chalk. They consisted of two specimens of *Liodon proriger*, Cope, and portions of jaws with teeth of four new Pythonomorph 1872.]

reptiles, viz.: *Edeslosaurus tortor*, Cope; *Holcodus coryphæus*, Cope; *H. ictericus*, Cope; and *Liodon curtirostris*, Cope. The first was regarded as a very slender form, with a cranium two and one-half feet in length, and with compressed teeth. The others were much stouter species, the *H. coryphæus* having a high occipital crest and long acute teeth. Length thirty feet. The two remaining species were about the same size.

The following gentlemen were elected members: Richard Day, Thos. E. Parke, M.D., Commodore John P. Gillis, U.S.N., Samuel W. Pennypacker, Richard A. Lewis, W. Grier Hibler, Louis Stillé, M.D., Jas. A. Ogden, Roland G. Curtin, M.D., Allen Shryock.

The following were elected correspondents: Geo. Stewardson Brady, M.D., of Sunderland, Eng'd., Prof. W. C. Kerr, of Raleigh, N. C., Dr. Jos. K. Corson, U.S.A., J. Van A. Carter, M.D., of Fort Bridger, Wyoming.

On favorable report of the committee, the following paper was ordered to be published:—

**NOTES ON FELDSPARS AND SOME OTHER MINERALS OF  
PHILADELPHIA AND VICINITY.**

BY THEODORE D. RAND.

*Orthoclase*, from the ravine three-quarters of a mile west of Media, the locality mentioned in Dana's Mineralogy as Mineral Hill. Color pale-greenish, two cleavages highly perfect, giving a prism four inches, by one and a half, by one and a half,  $90^\circ$ . Four other specimens from the same locality, one quite green, the others grayish and greenish, all with two perfect cleavages,  $90^\circ$ .

*Oligoclase*, from same locality, and intermixed with the former and with quartz, but showing opalescence, and sometimes chatoyant reflections, and, rarely, both on the same surface, the brachy-diagonal cleavage  $\propto P \tilde{\propto}$ . These cleavages were by no means so perfect as in the former, and but few specimens would admit of accurate measurements. The basal plane generally showed distinct but very fine striæ. The measurements are given below.

*Oligoclase*, from two miles west of Media, and southwest of the Black Horse Hotel. This is the whitish, translucent moonstone, occurring in very brilliant specimens. In this, as in the former, the cleavage surface parallel to  $\propto P \tilde{\propto}$  is frequently irregular and sometimes curved. There was also observed, in both this and the former, a third cleavage, still more imperfect. The measurements (with the common goniometer) were as follows:—

|  | Oligoclase, | 1                        | 2   | 3   | 4   | 5   | 6   | 7   | 8   |
|--|-------------|--------------------------|-----|-----|-----|-----|-----|-----|-----|
| $OP$ on $\propto P \tilde{\propto}$      | {           | 93.50                    | 93  | ... | 94  | 95  | ... | 94  | ... |
|  |             | 86.10                    | 87  | 88  | ... | 87  | ... | 86  | 87  |
| $OP$ on 3d cleavage                      | {           | (If $\propto P'$ 114.40) | ... | ... | 112 | 111 | 113 | 115 | 114 |
|  |             | 65.20                    | ... | 67  | 67  | 69  | 70  | 68  | ... |
| $\propto P \tilde{\propto}$ on 3d cleav. | {           | (If $\propto P'$ 120.24) | 119 | 120 | ... | 119 | 118 | 120 | 120 |
|  |             | 59.56                    | ... | 63  | ... | 64  | 60  | 63  | 63  |

1, 2, 3, and 4 are from the ravine near Media; 5, 6, 7, and 8 from near the Black Horse Hotel.

It seems probable that this third cleavage, which has not, I believe, been noticed before, is parallel to the plane  $\propto P'$  ( $I'$  of Dana), similar to that of orthoclase and albite.

*Sunstone*, from a ravine immediately north of that first described,  $90^\circ$ . Near this the Delawarite is found. My specimens 1872.]

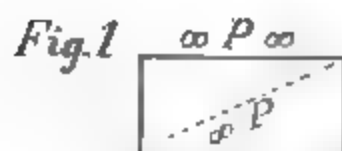
do not admit of accurate measurements, but in one specimen it graduates into oligoclase, and it is perhaps but an alteration of that species. It has distinct triclinic striations.

*Cassinite*, from Blue Hill, Providence Township, Delaware County, measures  $90^\circ$ .

*Lennite*, Lenni, Delaware County, a very perfect cleavage gave 86-87, but the absence of triclinic striæ would indicate that this is an orthoclase.

Bluish transparent veined Feldspar, from Van Arsdale's quarry, near Feisterville, Bucks County, Pa., two cleavages, highly perfect, and giving finely polished surfaces,  $90^\circ$ . The opalescent feldspar from the same quarry, called labradorite, is probably the same.

*Orthoclase*, from Frankford, Philadelphia, nearly pure white in color, and translucent. Besides the ordinary cleavages,  $0P$  and  $\infty P \infty$ , the more unusual,  $\infty P \infty$  and  $\infty P$ , are occasionally well developed, giving rise to two rhombohedra, one with the faces parallel to the axes, the other derived from this by the development of the plane  $\infty P$ , as shown in the annexed section on a plane parallel to  $0P$  (Fig. 1). Rhombohedra of the first form have been found also at the quarries on the Pennsylvania Railroad, near the west end of the Fairmount dam.

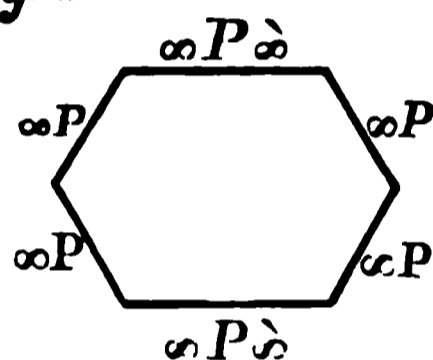


|                                       |           | 0P         | $\infty P \infty$ |
|---------------------------------------|-----------|------------|-------------------|
| 1                                     | . . . . . | 72         | 103               |
| 3                                     | . . . . . | { 112 69 } | { 101 80 }        |
|                                       |           | { 114 66 } | { 100 81 }        |
| 3                                     | . . . . . | { 112 68 } | { 100 80 }        |
|                                       |           | { 116 69 } | { 107 70 }        |
| 4                                     | . . . . . | { 112 69 } | { 100 83 }        |
|                                       |           | { 107 72 } | { 103 }           |
| 5                                     | . . . . . | 111 70     | 98 81             |
| The angle of $\infty P \infty$ is . . |           | 116 64     | 90 90             |

It is, however, most probable that this is a distortion of  $\infty P \infty$ .

In the cutting of the Pennsylvania Railroad, northwest of the wire bridge, an orthoclase was found, somewhat decomposed and chalky in aspect, cleaving into rhombohedra of the second kind, and also into six-sided prisms, terminated by the 0P plane, and from a slight distortion in angle the prism angles each measuring exactly  $120^\circ$  (Fig. 3).

*Fig. 3*



In Frankford, the orthoclase occurs in a granitic vein on the southern portion of the bed of hard hornblende gneiss, the N. E. outcrop of which is at this point, and which is exposed also near Wayne St. on the Germantown Railroad, and on Rittenhouse Lane near the Wissahicon, and which crosses the Schuylkill at the hill through which the Flat Rock Tunnel on the Reading Railroad is pierced. This gneiss throughout is very hard, and in its fissures occur several species of zeolites, with calcite, and at Frankford crystallized epidote in fine specimens, and also fluor spar in a vein of calcite, and well-crystallized molybdenite in a vein of orthoclase. The calcite contains also yellow crystals so minute as to be detected only by examination with the microscope, of the portion insoluble in hydrochloric acid. Their nature has not been determined, the quantity being very small. There also occurs a yellow hyaline coating, in veins of the gneiss, which is probably a hyalite, colored by uranium.

This gneiss, except near Wayne Station, is bedded with great regularity, and affords a most excellent curb and building stone; its fracture in one direction, owing to cleavage, is smooth and

plane, but in the others, when not jointed, irregular and sometimes conchoidal.

At a quarry on the northern edge of this gneiss, north of Frankford, Apophyllite was found; its only place of occurrence in the neighborhood.

At the line between Philadelphia and Montgomery counties, the well-known steatite bed, beginning on the west side of Chestnut Hill, about three miles distant, crosses the Schuylkill and continues in a nearly southwest by south direction (exactly S. 54 W.), beyond that river about two miles and a half, where it crosses the valley of Mill Creek, and ends, or sinks beneath the surface. Perhaps the most conspicuous and remarkable rock of this belt is a steatite, containing a black serpentine. This rock in many places projects above the surface of the ground in immense masses, particularly at Mill Creek, seeming to have resisted erosion and decomposition to a remarkable degree. It lies on the northwest side of the steatite proper. The whole aspect of this curious formation suggests a rock originally containing crystals of some mineral, but metamorphosed almost beyond recognition. To this mineral I believe no clue has heretofore been obtained. Nearly all these black masses, which vary in size from a half inch or less to several inches, are irregular in form, and adhere so closely to the matrix that sections only can be obtained, which, however, rarely show any angles or other than a nodular form, so that the rock has by some been considered a conglomerate. Even in weathering, the two, except in one place

faces. The steatite in which it was imbedded, and the serpentine itself, contained ferruginous dolomite or breunnerite.

On the northeast side of Mill Creek, a portion of the rock in place was found very much weathered on the surface, the steatite being cavernous and decomposed, and very soft and brittle, owing, probably, to a large admixture of ferruginous dolomite, but the serpentine gone entirely, save a little pulverulent oxide of iron; the cavities were nearly all lenticular in shape, but too regular to be other than matrices of crystals, while in two cases distinct cruciform cavities with angles of about  $60^{\circ}$  were observed. The portions of rock containing these were cut out, and in one of them lead was poured, and a cast obtained, which, while irregular and rough, was a fac-simile in metal of the common cruciform twins of staurolite. Portions of the same rock which had not altered were found containing the serpentine in distinct crystals, irregular in outline, but twinned at angles of about  $60^{\circ}$ .

*Serpentine.*—About a half mile above the soapstone quarries on the Schuylkill, occurs a ridge of serpentine which I believe has never been described. Its first appearance is at a slight cutting of the Philadelphia and Reading Railroad, opposite and a little above Lafayette station on the Norristown Railroad, and just below the vein of granite which crosses the Schuylkill below Spring Mill, and crops out at several points on the elevated hill of gneiss, which crosses the Schuylkill at Spring Mills. About a hundred yards S.W. from the river, it has been cut through by a small stream, and here it has been quarried as a building-stone, and is well exposed. The serpentine is very compact, at times slaty, of a very dark green, almost black, color, unlike that of any other ridge of the neighborhood, and resembling that of the Hartz. Intermixed, and also at the bottom of the quarry on the northwest, is a foliated mineral resembling Schiller spar, or serpentine, pseudomorphous after Pyroxene or Hornblende. The serpentine dips steeply toward the southeast, and at this point rises probably one hundred and fifty feet above the valley, abruptly and precipitously on the N.W., sloping on the S.E., where talcose and micaceous schists rest against it. About a half mile from the river, the ridge widens, the slopes are more gentle, and, for a short distance, the serpentine is hidden; but it again crops out about one mile from the river, where a road, parallel to the river, crosses the stream which has been mentioned, and which skirts  
1872.]

the ridge on the west. From this point it is narrower and well defined for a quarter of a mile to the next road parallel with the Schuylkill. Here the stream seems to have denuded it for about fifty yards, and a stream from the east joins that on the west. Beyond this it rises abruptly in a grove of cedars, and then continues, as a narrow, well-defined ridge, to its termination, which is abrupt, about one and three-quarter miles from the Schuylkill. In this part, as also in that between the two roads, it has almost the regularity and appearance of an old railroad embankment.

*Hisingerite*, from the Gap Mine, Lancaster County, Pa. Black amorphous; lustre between resinous and vitreous; streak, brown. Fracture conchoidal, brittle H  $2\frac{1}{2}$ –3 S. G. 2.11.

Analysis omitting 1.13 per cent. gangue:—

|                                |   |   |   |   |   |   |       |             |
|--------------------------------|---|---|---|---|---|---|-------|-------------|
| Water at 212                   | . | . | . | . | . | . | 14.30 |             |
| “ at redness                   | . | . | . | . | . | . | 9.89  | 24.19       |
| Silica                         | . | . | . | . | . | . | .     | 35.40       |
| FeO                            | . | . | . | . | . | . | .     | 12.53       |
| Fe <sub>2</sub> O <sub>3</sub> | . | . | . | . | . | . | .     | 27.46       |
|                                |   |   |   |   |   |   |       | <hr/> 99.58 |

In a cutting through decomposed mica shists, on the new line of the Philadelphia, Wilmington, and Baltimore Railroad, about a half mile southwest of Gray's Ferry, there is a white efflorescence, alkaline to the taste. It consists chiefly of sulphate of soda, an unlooked-for mineral in such location.

PHILADELPHIA, November 21, 1871.

THEO. D. RAND.

## DECEMBER 6.

Mr. TRYON in the chair.

Twenty-three members present.

The death of Mr. Jas. H. Orne was announced. The death of Sir Roderick J. Murchison, a correspondent of the Academy, was also announced.

The following paper was presented for publication:—

“Descriptions of new Western Palæozoic Fossils, mainly from the Cincinnati Groups of the Lower Silurian Series of Ohio.” By F. B. Meek.

Prof. COPE made some remarks on a peculiar habit recently observed by Alfred R. Wallace, in the *Phrynosomas*, in the Zoological Gardens in London. These animals eject from their eyes, in self-defence, a red fluid like blood. On inquiry of Dr. Edw. Palmer, of the Smithsonian Institution, who had spent some years in Arizona, whether he had observed such a habit in any of the species, he handed me the following extract from the “Arizona Miner” of August 20th, 1869:—

“Dr. Palmer and party got back here Wednesday evening last, from Bill Williams’ Mountain, E. J. Cook, one of the Prescott party that accompanied the expedition, informs us that a [horned] toad was found on the top of the mountain, which, when made mad, spurted blood from its eyes. It was secured by the doctor. The Prescott party did not find game as plenty as they had expected, yet they succeeded in killing one bear, eight or ten turkeys, and a deer. They say the country is the most beautiful ever seen by them. The valleys are many and large; pine, oak, and other timber covers the entire region, and the grass was waist-high. The region of country visited by them lies about 60 miles north of this place, on the line of the 35th parallel railroad route.”

This specimen is in the doctor’s collection, now in my hands, and belongs to the species *Phrynosoma ornatissima*, Gird.

---

DECEMBER 12.

The President, Dr. RUSCHENBERGER, in the chair.

Thirty-five members present.

*Notice of some Worms.*—Prof. LEIDY remarked that Prof. Hayden reports the brook trout, *Salmo fontinalis*, of the headwaters 1872.]



**Lake.** Neither of these appears to have been obtained since their first discovery.

Several large hair worms from Fish Creek, Montana, pertain to the species *Gordius lacutris*, previously described<sup>1</sup> from specimens obtained in Kansas. It is the largest known *Gordius*. The females of the Kansas specimens ranged from 10 inches to 2½ feet in length; the males, from 8 inches to upwards of 2 feet. The females of the Montana specimens measure from 1¼ to 2¼ feet in length; a male, 8½ inches in length. The females are pale brown; the males dark brown, and with a strongly-forked tail.

---

DECEMBER 19.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-one members present.

---

DECEMBER 26.

The President, Dr. RUSCHENBERGER, in the chair.

Twenty-five members present.

The following gentlemen were elected members:—

Andrew H. Miller, Dr. A. L. Gihon, U.S.N.

On favorable report of the committee, the following paper was ordered to be printed:—

<sup>1</sup> Proc. Acad. Nat. Sci., 1851, p. 275; 1857, p. 204. Amer. Entomol., vol. ii., p. 104.



same form as the corresponding pieces of the other rays described. (Other rays unknown.) Arms very long, slender, and bifurcating at least four times at irregular distances above the first divisions of the rays; pieces of the lower divisions generally longer than wide, rounded and constricted in the middle, and expanded at the ends; while those of the smaller terminal divisions are usually from three to four or five times as long as wide, and scarcely expanded at the ends. Surface smooth. Pinnulæ not seen.

First anal piece small, about as long as wide, and, as usual, resting between the superior sloping sides of the first radial on the left, and the second on the right, and bearing three or more others, in direct succession above, that doubtless form a part of the walls of the ventral extension.

Column small, distinctly pentagonal near the base, where it is composed of alternately thin and slightly thicker pieces.

Length of body, to top of the larger radial pieces forming a part of its walls, 0.14 inch; breadth, about 0.12 inch; length of rays and arms above the body, 1 inch; thickness of column near base, about 0.07 inch.

At the same time that I propose to name and describe this delicate little Crinoid as a new species, I suspect that it *may* not be distinct from *H. exilis* of Hall, which has not yet been illustrated, and has, unfortunately, been only briefly described. If Prof. Hall's description is *strictly accurate*, however, in several important characters, the form under consideration must be clearly distinct, as he states that the posterior lateral rays of *H. exilis* bifurcate on the *second* pieces, and the anterior lateral on the *fourth*; while, in the form here described, one of the posterior lateral rays bifurcates first on the *fifth* piece, and the other on the *eighth*; and, in the only one of its anterior lateral rays seen, the first division takes place on the sixth or seventh piece. He also says that the arms of *H. exilis* bifurcate *once* or *twice*, while in our type they bifurcate at least four times above the primary division of each ray. Again, he describes the body plates of *H. exilis* as having the general curve of the body; but in our type the subradial plates are so flattened as to impart a pentagonal form to the lower part of the body.

This species will be at once distinguished from *H. simplex*, by its frequently bifurcating arms and other well-marked characters. From *H. heterodactylus*, which also has its arms several times

1872.]

body (to say nothing of other differences), remove it, however, at once from that genus, as well as from *Mariacrinus*, from which latter it also differs materially in the structure of its arms and in other important characters. I suspect that it may be found to present sufficiently marked differences in this apparent fusing of the rays, as it were, into the walls of the body, up to the first bifurcation, to entitle it to rank as the type of a new group; but, without better specimens for study and examination, I prefer to refer it provisionally to *Dendrocrinus*, which can scarcely be regarded as more than subgenerically distinct from *Poteriocrinites*.

In general appearance, it seems to resemble most nearly *Dendrocrinus acutidactylus* and *D. gregarius* of Billings. It differs from the first, however, in having a more slender body, with proportionally longer arms, much less diverging at the bifurcations, as well as in having the two branches at each division unequal. From the latter species it also differs in the nature of its arms, as well as in having its column composed of very short pieces not presenting a bead-like appearance.

*Locality and position.*—Cincinnati group of the Lower Silurian, in the lowest beds seen at Cincinnati, Ohio. The survey is under obligations to Mr. C. B. Dyer, of Cincinnati, for the use of the only known specimens of this species.

**POTERIOCRINITES (DENDROCRINUS) CINCINNATIENSIS, Meek.**

Body of about median size, obconic, or tapering to the column from above, nearly or quite as wide at the top of the first radials

they spring, and sometimes themselves bifurcate once or twice; divisions composed of pieces about as long as wide.

First anal piece nearly as large as one of the smaller subradials, resting on the superior truncated edge of the largest heptagonal subradial, between the first radial on the left and the first and second on the right, while it supports others above that form the base of the ventral extension. Interradial pieces with the lowest piece of the ventral part resting between the truncated superior-lateral angles of the first primary radials so as to appear as minute interradians. Surface without costæ or sculpturing of any kind.

Ventral extension very long, or nearly or quite equalling the length of the arms, and as wide as the body below; composed of the usual small hexagonal plates apparently without costæ, and separated by punctured sutures. Column slender, slightly tapering downward just below the base, near which it is more or less pentagonal, and composed of short alternately thicker and exceedingly thin segments. Farther down, it becomes nearly or quite cylindrical, and composed of more uniform very short pieces, with a very small nearly or quite round perforation.

Length of body, from the lower end of base to the top of first primary radials, 0.24 inch; breadth of do., at top, 0.16 inch; length of rays, from top of body to first bifurcation, 0.20 inch; length of arms, above this bifurcation, 2.30 inches; diameter of column, 0.04 to 0.05 inch.

This delicate little species seems to agree exactly, in structure as well as in physiognomy, with *Dendrocrinus*, excepting that it *appears* to have the small pieces forming the lower part of its ventral extension above the first anal piece, and those seen in the interradian spaces above the large first radials that form a part of the walls of the body, connecting laterally with the succeeding smaller radials, nearly or quite up to the first bifurcation. This arrangement, if it really exists, would make these smaller primary radials, above the body proper, as it were, a part of the walls of the body or ventral extension; so that the rays would only become free at the first bifurcation. The specimens seen are not in such condition as to remove all doubts on this point; but, in some conditions, these little pieces between the rays give that part of the fossil somewhat the appearance of a *Glyptocrinus*. The presence of well-developed subradials and a long ventral extension of the 1872.]

men had only a segment or two of the column attached; but an end view of it, in his diagram, represents it as being *round*, while in the form under consideration it is very distinctly pentagonal. As he does not say that it differs in the form of the column from his *P. alternatus* (which has a decidedly round column), in pointing out the distinctions between the two, I also infer that it is round in both. In addition to this, *Poteriocrinites gracilis* of Hall is stated by him to be found only at the base of the Trenton limestone, while our crinoid is only known to occur in the middle part of the Cincinnati group. From these facts, and from the usual very restricted vertical range of the species of *Crinoidea*, I infer that our Cincinnati form is specifically distinct from the New York species.

*Locality and position.*—One hundred feet below tops of hills at Cincinnati, Ohio. Cincinnati group of the Lower Silurian. Mr. C. B. Dyer's collection.

**POTERIOCRINUS (DENDROCRINUS) POLYDACTYLUS, Shumard (sp.).**

*Homocrinus polydactylus*, Shumard, 1867. Trans. Acad. St. Louis, vol. I. p. 78, pl. I. fig. 6.

An examination of good specimens of this species shows that it has the structure of the body seen in *Dendrocrinus*, and that it is related to *D. Jewettii* of Billings more nearly than to any other of the species known to the writer.

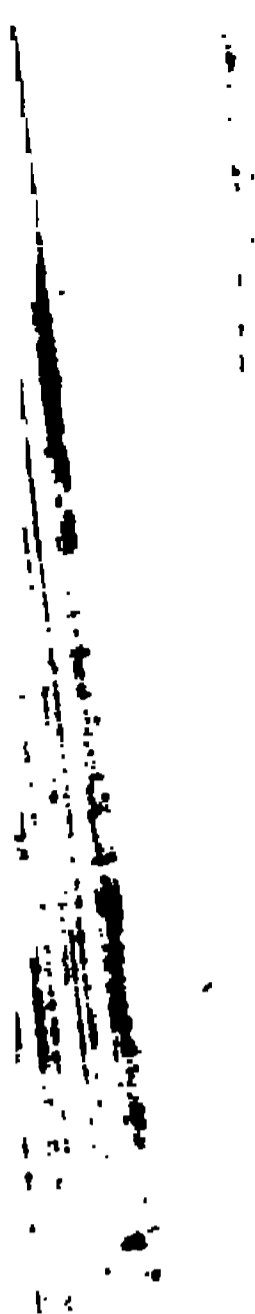
This is a rather common species in the upper part of the Cincinnati group at Richmond, Indiana.

high, and presenting a trigonal general outline, though the lateral angles are doubtless minutely truncated. First radial pieces of moderate size, heptagonal in form, and wider than long; second and third a little smaller, the second being hexagonal, and the third pentagonal, and supporting on its superior sloping sides the first divisions of the rays. Secondary radial or supraradial series each composed of from eight to eleven pieces, rapidly diminishing in length upward to the second bifurcation or commencement of the arms, just below which a few of the smaller pieces seem to be free and bear pinnulæ on their inner sides; farther down, the second and fourth secondary radials of each ray give off, alternately on each side, small divisions that do not become free, but are soldered into the interrarial walls, though they can be traced to the summit of the body, where they merely give origin to pinnules.

Anal area a little wider than the interrarial areas. First anal plate of about the same size as the first radials, hexagonal in form, and supporting in the next range three pieces, arranged with the middle one higher than the others; while, above these, three smaller pieces can be seen arranged in the same way in the third range, and three to four or five in the fourth, which is as far up as they can be traced. The middle plates of this series form a direct vertical row, that have a rather prominent mesial, rounded ridge extending all the way up from the middle of the lowest piece, of about the same size as those passing up the primary and secondary radial series, while the other plates on each side and other parts of the lowest pieces are ornamented with radiating costæ of smaller size, like those on the interrarial pieces.

Interrarial areas not excavated below, but becoming moderately concave above; first interrarial pieces of about the size of the second primary radials, hexagonal in form, and supporting two other somewhat smaller pieces in the next range, that bear between their superior sloping sides a fourth smaller piece, while above these there are two pieces in the next range that connect with the pieces of the little lateral divisions of the secondary radials, and perhaps some other small intercalated pieces filling the upper part of the interrarial areas.

Axillary areas flat, and each occupied below by a hexagonal or heptagonal piece of about the size of the second piece of each



six of the arms, that seems to agree exactly, in structure, ornamentation, and form, with the last, excepting that its body is not quite so rounded below; and it has a more robust appearance, in consequence of having the ridges up the radial and secondary radial series (particularly the latter), as well as that up the middle row of the anal plates, rather decidedly stouter and more prominent. Its arms are also proportionally stouter, and composed of shorter pieces.

This may be specifically distinct from the last; but, with the present means of comparison, I prefer to range it provisionally as a variety of the same, under the name *Glyptocrinus Dyeri*, var. *subglobosus*.

*Locality and position*.—Same as last.

## MOLLUSCA.

### POLYZOA.

#### PTILODICTYA (STICTOPORA) SHAFFERI, Meek.

Polyzoum small and delicate, consisting of slender, compressed divisions, that give off on each side rather closely arranged, regularly alternating, lateral branches of the same breadth as the main stems, from which they diverge at an angle of about forty degrees; lateral branches in the same way giving off on each side very short lobe-like, alternating projections; lateral margins of all parts very narrow, sharp, and minutely striated longitudinally, in well-preserved specimens; pores apparently without raised margins, more or less oval longitudinally, alternately disposed in longitudinal and oblique rows, so as to present a quincuncial arrangement; the number of longitudinal rows varying from five to about seven in the breadth of a stem or branch; spaces between the pores, measuring transversely to the stems and their divisions, about equal to the breadth of the pores, but greater, measuring in the direction of the oblique and longitudinal rows; all the interspaces ornamented, in perfectly preserved specimens, by very minute, more or less waved or flexuous striæ.

Size of entire polyzoum unknown; breadth of stems and branches, 0.05 inch; number of pores in 0.05 inch, measuring in the direction of the oblique rows, about 4 to 6, and, in the same space, measuring longitudinally, from 3 to 4.

1872.]

This very delicate little form will be readily distinguished from the other known Silurian species by its small size and peculiar plumose mode of growth, and particularly by its very minute striæ between the pores. *Stictopora raripora*, Hall, from the Clinton group of New York, is as delicate a form, but differs materially in its mode of growth, and particularly in its very much less numerous pores.

The specific name is given in honor of Mr. D. H. Shaffer, of Cincinnati, Ohio, to whom I am indebted for the use of a very fine specimen of it; I also have good specimens from Mr. Dyer's collection.

*Locality and position.*—Toward the lower part of the Cincinnati group of the Lower Silurian at Cincinnati, Ohio.

### BRACHIOPODA.

#### BETZIA (TREMATOSPIRA) GRANULIFERA, Meek.

Shell transversely oval, the length being about four-fifths the breadth, moderately convex, the convexity of the two valves being very nearly equal; lateral margins rather narrowly rounded in outline; front and anterior lateral margins broadly rounded, or perhaps the former sometimes straight or slightly sinuous in outline in the middle; cardinal margin nearly straight on each side, and sloping at an angle of about  $140^{\circ}$  from the beaks toward the lateral extremities. Dorsal valve nearly evenly convex, its greatest prominence being perhaps slightly behind the middle, provided with about thirteen simple, granular, radiating ribs.

smaller ones being a little depressed so as to form a shallow mesial sinus that is not continued to the beak. Crossing all of these plications of both valves, are numerous fine lines of growth; while the entire surface, as seen under a magnifier, is occupied by minute projecting points, like grains of sand; and, between these, a higher magnifying power shows the whole surface to be very minutely and regularly punctate.

Length, 0.37 inch; breadth, 0.50 inch; convexity, 0.27 inch.

Until the distinctions between the genus *Retzia*, and the proposed genus *Trematospira* (if any exist) are better defined, and the interior of the species here described can be determined, it is not possible to say to which of these groups it most properly belongs.

Specifically, however, it seems to be closely allied to *Trematospira gibbosa* of Hall, from the Hamilton group. Yet it differs, not only in having two to three more plications on each side, but also in having five instead of three a little raised to form the mesial fold of the dorsal valve (the middle one being also much smaller), and four depressed to form the mesial sinus (the middle two being much smaller than the others). It so nearly resembles the New York form, however, that I should almost be inclined to suspect that it might be only a variety of the same species, if it were not found at a so much lower horizon. It must be very rare, as I have only heard of the single typical specimen being found.

*Locality and position.*—Cincinnati group of the Lower Silurian; from the basal beds at Cincinnati, Ohio. Mr. Dyer's collection.

## LAMELLIBRANCHIATA.

### AMBONYCHIA (MEGAPTERA<sup>1</sup>) ALATA, Meek.

*Megapteraa Casei?*, James, 1871. Cat. Fossils of Cincinnati Group (not Meek and Worthen).

Shell attaining a moderately large size, subtrigonal in general outline, compressed postero-dorsally, and more convex in the um-

<sup>1</sup> In first proposing the name *Megaptera*, for these great winged species, in 1866, Mr. Worthen and the writer were not aware that this name had been previously used by Dr. Gray for a genus of Whales. Naturalists do not agree in regard to the propriety of retaining the same name for different genera or subgenera in such cases. Where the groups belong to the same 1872.]

bonal and antero-central regions; umbonal slopes ranging at an angle of about fifty degrees below the hinge line, and broadly rounded; hinge line straight, very nearly or quite equalling the greatest antero-posterior diameter of the valves, and ranging nearly at right angles to the anterior side of the same; posterior alation very large, not separated from the swell of the umbonal and central regions by any defined sulcus, slightly rounded at its immediate extremity above; posterior margin faintly sinuous for a little below its intersection with the hinge margin above, thence sloping forward and downward, and finally rounding into the regularly rounded base; anterior side more or less concave, and nearly vertical above, but rounding regularly into the base below; beaks terminal, rather pointed, rising little above the hinge line, and directed a little obliquely upward and forward, with more or less inward curvature.

Surface ornamented by about twenty-four to twenty-eight simple, strong, radiating costæ to each valve, that are nearly equal in breadth to the furrows between; those on the central portions of the valves passing nearly straight from the beaks obliquely to the posterior basal margins, those on the anterior side curving more or less forward below, and those near the cardinal margin curving a little upward behind. Crossing all of these costæ, and the furrows between, are numerous fine crowded lines, and, at regular distant intervals, a few strongly defined imbricating marks of growth that curve parallel to the basal and posterior margins.

Height, 2.30 inches; breadth, 2.20 inches; convexity, about 0.80



are really distinct specifically, the *M. Casei* being marked by very numerous alternating larger and smaller radiating striæ, while *M. alata* is ornamented with large, strong radiating ribs. *M. Casei* also differs in having its umbonal slopes distinctly angular, instead of broadly and evenly rounded, as in the species under consideration; while its ventral margin is angular in outline, at the termination of the umbonal ridge, instead of being rounded. Its marks of growth also show that the extremity of its wing was rather acutely pointed, instead of being a little rounded.

*Locality and position.*—Clinton County, Ohio, in upper part of the Cincinnati group of the Lower Silurian. Mr. James's collection.

**MEGAMBONIA JAMESI, Meek.**

*Megambonia? Spinneri?* James, 1871. Cat. Fossils Cincinnati Group, p. 12. (Not *M. Spinneri*, Hall.)

Shell attaining a rather large size, a little obliquely subovate in general form, rather convex, the most gibbous part being somewhat above and in front of the middle, more or less abruptly cuneate posteriorly and below; basal outline regularly rounded; posterior margin rounding into the base, and ascending with a convex curve and forward inclination to the posterior extremity of the hinge, which is not in the slightest degree alate; anterior margin rounding into the base below, and slightly sinuous under the lobe-like protuberance, or rudimentary wing above, which is convex, slightly more prominent than the margin below, and defined from the swell of the umbonal regions on each side, by an oblique sulcus extending to the hinge margin in front of each beak; hinge equalling about two-thirds the antero-posterior diameter of the valves; beaks rather prominent, or rising distinctly above the hinge line, but slightly oblique, and distinctly incurved; umbonal slopes broadly rounded; longer axis of the valves moderately oblique to the hinge line. Surface ornamented by very regular, rounded, simple, and depressed radiating costæ, a little wider than the furrows between, and numbering about five in a space of 0.30 inch, near the middle of the lower margin.

Height, about 2.05 inches; antero-posterior diameter, 2.16 inches; convexity, 1.50 inch.

The only specimen of this species I have seen is a cast of the exterior, with portions of the ventral and anterior ventral margin. 1872.]



**SEDGWICKIA? FRAGILIS, Meek.**

Shell rather small, apparently very thin, longitudinally oblong or suboval, rather distinctly convex along the umbonal slopes from the beaks toward the posterior basal margin, and down near the anterior side, while just under the beaks a rather strongly marked impression descends, widening and deepening as it approaches the base; basal margin subparallel in its general outline to the dorsal, but diverging more or less posteriorly, where it is most prominent and distinctly sinuous toward the front; posterior margin wider than the anterior, and more or less truncated; anterior extremity very short, and rounded or somewhat truncated; hinge line straight, and shorter than the entire length of the valves, apparently very slightly inflected behind the beaks, which are raised a little above the cardinal margin, incurved, contiguous, flattened on the outer sides, and placed near the anterior end, with a slight forward inclination. Surface ornamented with moderately distinct lines and irregular minute wrinkles of growth.

The only specimens of this species yet known to me are too imperfect to afford exact measurement, though they seem to have been, when entire and undistorted, about 0.90 inch in length, 0.73 inch in height, and 0.40 inch in convexity. They present some appearance of having been gaping behind and in the anterior ventral region. One specimen looks as if it had been truncated, with a backward obliquity from below upward behind, but this may be due to distortion.

I am far from being satisfied that this shell is congeneric with the forms for which Prof. McCoy proposed the name *Sedgwickia*, as nothing can be determined from the specimens yet known, in regard to its hinge and muscular and pallial impressions. Possibly it would be nearer right to call it *Modiolopsis fragilis*; but there is something in its physiognomy that suggests affinities to Carboniferous types referred to *Sedgwickia* and *Allorisma*.

*Locality and position.*—Cincinnati group of the Lower Silurian, at about 350 feet above low-water mark of the Ohio River, at Cincinnati, Ohio. Mr. U. P. James's collection.



shorter anterior, and straighter basal outline, to be referred to that species, even if found in rocks of the same age, while the rather wide interval between the horizons at which the two forms occur, renders it still more improbable that they belong to the same species.

It is extremely difficult to arrive at correct conclusions in regard to the generic affinities of such shells, from the study of mere casts, and it is, therefore, only provisionally that I have referred this and the last-described species to the genus *Sedgwickia*. We may rest quite well assured, however, that palæozoic forms of the kind cannot be properly referred to the existing genus *Anatina*.

*Locality and position.*—Same as last. Mr. James's collection.

**SEDGWICKIA (GRAMMYSIA?) NEGLECTA, Meek.**

Shell transversely ovate, about one-third longer than high, rather distinctly compressed, most convex and most elevated in the central and umbonal regions, and compressed-cuneate behind; anterior margin rounding from the lower end of the lunule into the base, which forms a nearly semi-oval curve, its most prominent part being near the middle; cardinal margin apparently straight, and declining posteriorly from the beaks; posterior margin rather narrowly rounded; beaks moderately prominent, and scarcely one-third the length of the valves from the anterior margin. Surface ornamented with regular, distinct, but not very prominent concentric costæ, that become suddenly obsolete on the posterior third of the valves. Lunule narrow, but sharply defined.

Length, about 1.04 inch; height, 0.67 inch; convexity, about 0.35 inch.

The only specimen of this species I have seen is an external cast of the right valve, which has evidently been, to some extent, accidentally compressed in the region of the beak, but the shell was certainly never very convex. It has almost exactly the general aspect and kind of ornamentation seen in the typical forms of *Sedgwickia*, a group which, since it was first proposed by Prof. McCoy, has been included by him in his genus *Leptodomus*, which seems to me to have been originally founded on a very distinct type.

Our shell also resembles rather closely some forms apparently 1872.]



little gaping; and the posterior side may have been more or less so, though the specimen is not in a condition to show whether this was the case or not.

Although I refer this shell, for the present, provisionally, to *Dolabra* of McCoy, I really have very little idea that it properly belongs to that genus (as typified by *Cucullæa angustata* of Phillips), to which I have in some other cases referred similar shells, the generic relations of which could not be determined. On the contrary, I strongly suspect that it will hereafter be found necessary to establish a new genus for such forms, when specimens showing the hinge can be examined. If so, I would propose for the group the name *Rhynchotropis*, in allusion to the sharply carinated character of the beaks in the typical form now under consideration. The group, whatever name may be retained for it, evidently includes *Dolabra? Sterlingensis* of Meek and Worthen.

Specifically, the form under consideration will be distinguished from *D.? Sterlingensis* by its much smaller size, and more spiral and much more sharply keeled beaks, as well as by its shorter anterior margin. It must be very rare, as I have only seen among all the collections the single typical specimen.

*Locality and position.*—Cincinnati group, about 175 feet below tops of hills at Cincinnati, Ohio. Mr. Dyer's collection.

#### **CARDIOMORPHA? OBLIQUATA, Meek.**

Shell small, rhombic-cordate, very convex, higher than long; posterior margin sloping rather abruptly, and subtruncate, or a little convex in outline from the posterior extremity of the hinge to the posterior basal extremity, which is more or less angular, or narrowly rounded; basal margin short, nearly straight or a little convex from the posterior basal extremity to the front; anterior margin short or truncated from immediately in front of the beaks obliquely downward and backward to the base, which it joins at an obtuse, slightly rounded angle; hinge line very short, ranging at an angle of about fifty degrees to the umbonal axis, and apparently having its margins a little inflected behind the beaks; beaks very prominent, oblique, nearly or quite terminal, and strongly incurved; posterior umbonal slopes subangular near the points of the beaks, but becoming rounded below, while the dorsal region between this and the hinge is a little concave; anterior umbonal slopes, forming a kind of ridge that extends, at 1872.]



while those below suddenly increase in size much more rapidly than the others, particularly in the direction of the longer axis of the shell, and form most of its bulk; these larger turns, in large adult examples, sometimes assuming together a subcylindrical outline; the last or body whorl comparatively long, subcylindrical or more or less oval, and somewhat produced below; suture moderately distinct, almost transverse between the smaller upper turns, but becoming decidedly more oblique below; aperture comparatively small and narrow, apparently subrhombic; inner lip much thickened all the way up; columella twisted so as to form a single prominent fold below the middle of the aperture. Surface nearly smooth, or only showing very obscure lines of growth. (Outer lip unknown.)

Length of one of the largest, most elongated specimens, 2.23 inches; breadth, 0.87 inch; length of aperture, about 1 inch.

This fine species most nearly resembles *M. Newberryi* of Stevens, but may be readily distinguished by its form, the slopes of the upper part of its spire being distinctly concave, and the lower part convex in outline, instead of being evenly and moderately convex all the way down. This peculiarity is caused by the sudden enlargement of the middle and lower volutions, and the greater obliquity of their spiral curve; while, in *M. Newberryi*, the volutions increase in size regularly, and have the same uniform spiral curve from the apex throughout the whole length of the spire. Young examples of the form under consideration are proportionately shorter, the elongation being to a considerable extent produced by the obliquity and prolongation of the last two volutions. These less elongated younger shells, however, will be distinguished from *M. Newberryi* by the concave slopes of their spires, and the greater proportional breadth of their body volutions. This is also a larger and more robust species than *M. Newberryi*.

As none of the specimens yet seen have the outer lip and lower part of the aperture entire, the form of the aperture cannot be made out; and there may even be room for some little doubt whether or not it is, in perfect examples, narrowed and produced into a canal below. If this is the case, the name of the species should be *Soleniscus Klipparti*, as it appears to present very nearly the other characters of the type of that group.

The specific name is given in honor of John H. Klippart, Esq., of Columbus, Ohio, Secretary of the State Agricultural Society, 1872.]

2

11

12

by him; and it seems to be equally distinct from all of those described in this country and Canada.

The specific name is given in honor of Prof. Edward Orton, of the Ohio Geological Survey.

*Locality and position.*—Cincinnati group, at Cincinnati, Ohio. Mr. Dyer's collection.

## ARTICULATA.

### CRUSTACEA.

#### CYTHERE CINCINNATIENSIS, Meek.

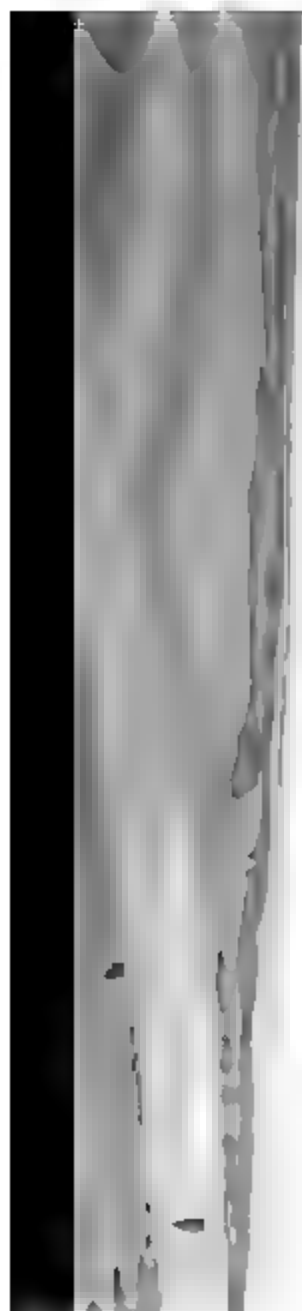
Carapace-valves varying from transversely suboval to subcircular; moderately and rather evenly convex, the greatest convexity being in the central and anterior regions; without any visible tubercle or nodes; ventral margins rounded or semioval, and but slightly unequal or thickened; anterior and posterior margins more or less rounded, the former being more broadly rounded generally than the latter; hinge margin very short, very slightly sinuous just behind the umbones, and rounding into the posterior margin so as scarcely to produce any visible angularity; umbones, near the anterior, a little tumid, rising very slightly above the hinge, and rounding off regularly into the anterior margin. Surface nearly smooth.

Length of one of the larger nearly circular specimens, 0.21 inch; height, 0.17 inch; convexity, 0.11 inch. Length of a smaller more oval specimen, 0.14 inch; height, 0.08 inch; convexity, 0.07 inch.

This species seems to vary a good deal in form, some specimens being, as the above measurements indicate, proportionally higher, and thus presenting a more rounded outline. It is possible that these forms may belong to two distinct species; but, with the specimens yet accessible for study, I have not felt warranted in separating them.

*Locality and position.*—Cincinnati group, at Cincinnati, Ohio. Mr. Dyer's collection.

The following interesting Crustacea were discovered by Prof. Frank H. Bradley, of Knoxville, Tennessee, at the base of the Waverley group, at Danville, Kentucky. As the same species will doubtless yet be found at this horizon in Ohio, they are here  
1872.]



Dr. S. I. Smith, of that city, and himself, concur in the opinion that they do not properly belong to the same genus as the typical forms of *Ceratiocaris*.

The differences to which I have alluded consist, first, in the form of the carapace-valves, which, instead of being truncated, with a nearly straight outline from below forward and upward, are truncated from above forward and downward, with a *profoundly sinuous outline*, the sinus being directed forward and upward, while the posterior extremity of the dorsal margin is produced, pointed, and curved downward. Again, they show a peculiar flexure of the ventral margin, so as to form a kind of linear carina. In the species *Bradleyi*, this margin is always inflected along this line, at an acute angle inward and upward; while in the species *elytroides*, it is less strongly deflected, though the linear carina is equally well defined, and sometimes minutely crenated. This species also shows another minutely crenated, obscurely defined carina below the dorsal margin, and would therefore bear some resemblance to *Dithyrocaris*, in this respect, but otherwise, particularly in form, its carapace-valves are quite different from those of that type.

It is also worthy of note, that none of the several specimens of these species show any traces of the ocular spot or tubercle, constantly seen in the typical species of *Ceratiocaris*; and that they show a clean, smooth outline to the dorsal margins of the carapace-valves, indicating that they were only united by a membrane; while those of *Ceratiocaris* were supposed by Prof. McCoy to be anchylosed, and rigidly united at a fixed angle along the dorsal margin.

I have no doubt in regard to the importance of some, if not all, of these points of difference, but, knowing how slow many geologists (who are generally far behind zoologists in the discrimination of genera) are to accept such divisions, I have merely distinguished these species for the present, as belonging to a subgenus of *Ceratiocaris*, under the name *Colpocaris*, in allusion to the sinus of the posterior margin.

*Locality and position.*—Base of the Waverley group, at Danville, Kentucky. Prof. Bradley's collection.



**CERATIOCARIS (SOLENOCARIS) STRIGATA, Meek.**

Carapace-valves narrow, and elongated, rather convex, with length about four times the height; dorsal and ventral margins nearly straight and parallel, anterior extremity very narrowly rounded, being most prominent at the middle; posterior end very obliquely truncated from below backward and upward so as to impart a more or less angular or pointed character to the posterior dorsal extremity, which, however, is not curved. Surface of internal cast showing rather well-defined marks of growth parallel to the margins; while moulds of the exterior show impressions of coarse, more or less anastomosing, longitudinal striæ, that do not curve exactly parallel to the free margins, particularly of the ends. No ocular spot or tubercle visible.

Length, 1.24 inch; height, about 0.30 inch; convexity, about 0.25 inch.

I did not submit this form to Professor Dana, but as it differs quite as materially (though in other respects) from *Ceratiocaris* as those I sent to him do, and as widely, or even more widely, from those I sent than the latter do from *Ceratiocaris* proper, I have ventured to suggest for it at least a subgeneric name, *Solenocaris*. It shows no traces of ocular spots, and merely has the posterior end subtruncated obliquely backward from below, without any traces of a sinus. At a first glance, it looks like the valves of a narrow bivalve mollusk; but its sculpturing is decidedly of crustacean type, being like that of some species of *Ceratiocaris*.

*Locality and position.*—Same as preceding.

**ARCHÆOCARIS VERMIFORMIS, Meek.**

The specimens of this fossil yet known are too imperfect to be systematically characterized, but they may be described, in a general way, as follows; the description being intended to apply to a side view of individuals as seen more or less compressed laterally in concretions.

Cephalothorax or head, about equalling the length of the first three and a half of the body segments behind it; subtrigonal in form, being somewhat pointed in front, with the posterior margin wider and obliquely truncated from above backward and downward, so as to give more or less angularity to the posterior basal extremity; basal margin apparently with a kind of ridge or fold  
1872.]



THE following reports were read, and referred to the Publication Committee:—

### THE LIBRARIAN'S REPORT.

The Librarian respectfully reports that the number of additions to the library from January to December, 1871, inclusive, amounts to 1236.

Of these 165 were volumes, 1060 pamphlets and parts of periodicals, and 11 maps and charts. They were derived from the following sources:—

Societies 462, Editors 206, Wilson Fund 94, Authors 92, Publishers 60, Dr. H. C. Wood 31, Isaac Lea 28, Norwegian Government 18, Secretary of Treasury 15, Geological Survey of Sweden 12, Government of Chile 8, Geological Survey of Italy 7, Geological Survey of India 5, Thos. Meehan 5, J. B. Lawes 5, Minister of Public Works in France 5, J. S. Newberry 3, T. Guilford Smith 2, Smithsonian Institution 2, Chief of Engineers U.S.A. 2, Dep. of Interior 2, Dr. Jos. Leidy 1, Dr. H. C. Chapman 1, Col. Jas. Greer 1, Jos. Jeanes 1, P. P. Carpenter 1, Commissioner of Fisheries 1, D. F. Boyd 1. 85 were purchased and 80 presented through the Conchological Section.

These additions were distributed to the different departments of the library as follows: Journals 761, Geology 80, Bibliography 92, Entomology 47, History and Statistics 45, Conchology 39, General Natural History 25, Ornithology 11, Ichthyology 9, Physical Science 8, Botany 7, Anatomy and Physiology 7, Helminthology 7, Agriculture 6, Mineralogy 6, Voyages and Travels 2, Medicine 2, Chemistry 1, Mammalogy 1. 251 volumes have been bound.

During the year the revised and numbered catalogue of the Conchological Department has been completed, and is now in the hands of the binder.

Thirty-two applications for books wanting in the library were made by means of the blanks provided for the use of members. Fourteen of the required works have been received, and the others have been ordered.

Estimating the number of volumes formed by the pamphlets 1872.]

and periodicals received during the last two years, the whole number of volumes now in the library is 22,693.

All of which is respectfully submitted,

EDWARD J. NOLAN, *Librarian*.

---

### REPORT OF THE CURATORS.

The donations to the Museum of the Academy during the year are as follows:—

*Vertebrates*.—A fine specimen of a Manatee, *Manatus latirostris*, from St. Domingo, was presented by Mr. William M. Gabb. It has been mounted, and now occupies a place in the museum. We may also state that the Sea lion, *Eumetopias Stelleri*, from California, presented last year by George Davidson, has also been prepared and placed in the museum.

Mr. B. A. Hoopes presented a hybrid between the domestic Brahma cock and the Guinea fowl, raised by himself. A peculiar variety of the *Bernicla canadensis*, from Indiana, was presented by Gen. L. E. Yorke, of Cincinnati, Ohio. A parrot and a toucan were presented by Miss LeClair, and a Snow Bunting from Alaska, by S. R. Roberts.

A collection of fishes, in eighteen jars, from St. Domingo, was presented by William Gabb; a collection, in eight jars, from the Delaware river, by Dr. C. Arrott, and a *Hippocampus*, by W. A. H. Allen, U.S.N.

tera, from Texas, by Dr. G. Lincecum ; and a small collection of coleoptera, by J. R. Willis, of Halifax, N. S.

The spawn of a mollusk from the Pacific was presented by Dr. Geo. Davidson, and a specimen of *Pheronema Grayi*, by W. Saville Kent.

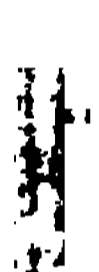
*Osteological, Ethnological, and Miscellaneous Specimens.*—A well-preserved mummy from near Ancon, Peru, was presented by Mr. Edm. W. Sartori. Two skulls of Caciques, of the Peguenche tribe, of Chili, were presented by Dr. S. Wier Mitchell. The skull of a Flat-head, from Washington Territory, was presented by Dr. J. M. Kollick. The skull of a Walrus, from Sable Island, N. S., was presented by J. R. Willis, of Halifax, N. S.

The following specimens were also received: A shark's jaws, from Capt. Westcott, U.S.N.; the dermal covering of a large Alligator Gar, from Mr. Swain; three ancient stone hammers from the copper region of Keweenaw Pt., L. S., from Francis R. Abbott; a section of a birch tree, fifteen inches in diameter, cut by beavers, from Keweenaw Pt., L. S., from B. A. Hoopes; and the fangs of a large Rattlesnake from California, from Prof. A. Du Bois.

Dr. H. C. Yarrow presented a small collection of shells, bones, and fragments of pottery from ancient shell heaps on Hawkins's Island, N. C.

*Fossils.*—Dr. J. Van A. Carter and Dr. Joseph K. Corson, U.S.A., of Fort Bridger, Wyoming, presented a collection of remains of extinct mammals, crocodilians, and chelonians, and some shells, from an early tertiary deposit of Wyoming. These remains pertain to species described during the year in the Proceedings of the Academy. Dr. Showalter presented a large portion of the skeleton, including the skull of *Clidastes iguanavus*, from the cretaceous formation of Alabama. Dr. Isaac Lea presented a portion of the lower jaw of *Rhinoceros tichorhinus*, and a molar of *Elephas primigenius* from near Florence, Italy. Mr. S. R. Roberts presented a small collection of mosasauroid remains from Kansas. There were also presented the following: Six fossils, by J. W. Queen; five by Mrs. R. Hoffman; two by T. Guilford Smith; three by Thomas Meehan; two by Dr. H. C. Chapman; two by Lotta Town; one by Guy Bryan; one by C. S. Westcott; one by C. S. Bement; one by Mr. Castor; and one by an unknown donor.

*Plants.*—Sixty-seven species of Mexican plants were presented by C. Mohr, of Mobile. A collection of plants from the vicinity 1872 7



# RECORDING SECRETARY'S REPORT.

The Recording Secretary would respectfully report that, during the year ending November 30th, 1871, there have been elected thirty-five members and eight correspondents.

The announcement has been made of the death of the following members and correspondents:—

Four members, namely: Dr. Charles M. Wetherill, Benjamin Marshall, William P. Turnbull, Stephen Morris, Esq.

Six correspondents, namely: Wilhelm Ritter von Haidinger, Prof. E. E. Adams, D.D., F. F. Cavada, Mr. J. J. Cohen, Prof. Constant Duméril, Dr. John Edward Holbrook.

The number of papers contributed and ordered to be printed in the Proceedings of the Academy during the year, has been nineteen, as follows:—

|                               |   |                            |   |
|-------------------------------|---|----------------------------|---|
| Prof. L. B. Buckley . . . . . | 1 | Prof. F. B. Meek . . . . . | 3 |
| Robert Ridgway . . . . .      | 1 | T. Meehan . . . . .        | 1 |
| Elliott Coues, M.D. . . . .   | 2 | Edward D. Cope . . . . .   | 2 |
| Prof. A. Newton . . . . .     | 1 | Prof. C. Thomas . . . . .  | 1 |
| Isaac Lea, LL.D. . . . .      | 2 | J. A. Ogden . . . . .      | 1 |
| T. Hale Streets . . . . .     | 2 | G. N. Lawrence . . . . .   | 1 |
| Theodore D. Rand . . . . .    |   | 1.                         |   |

All of which is respectfully submitted,

SAMUEL B. HOWELL,  
*Recording Secretary.*

## REPORT OF RECORDER OF MICROSCOPICAL AND BIOLOGICAL SECTION.

Extract from the Minutes of the Biological and Microscopical Section at the meeting held December 4th, 1871.


“The Report of the Recorder being in order, it was called for, and after being read was, on motion of Dr. Tyson, adopted and directed to be transmitted to the Academy at its approaching annual meeting, as the Report of the Section,” to wit:—

In accordance with that regulation of the Section which requires the Recorder to lay before you a written report of the transactions during the year in our department, I have the honor to submit the following summary of scientific labor accomplished within the past twelve months; and whilst it is incontestably true that 1872.]

this exhibit cannot compare favorably with those of other like periods, it must, I think, be admitted that evidence is thereby afforded of an earnest determination to keep alive some interest in the study of microscopy.

Valuable donations have been from time to time received from Dr. J. J. Woodward, of the Surgeon-General's Office, at Washington, consisting of specimens of his admirable micro-photographs of histological preparations, test objects from the Diatomaceæ, &c. &c.

Among the more important contributions laid before the department may be mentioned one from Dr. James Tyson, on a method of demonstrating the reversal of light and shade occurring in the red blood-corpuscles under microscopical examination, which was subsequently printed in the *Philadelphia Medical Times*. One from Dr. J. H. McQuillen, upon a remarkable example of hypertrophy of the root of a tooth, the specimen being first exhibited to the members in its natural state, and its construction being afterwards demonstrated by carefully prepared and mounted sections. Another from the same gentleman on imperfections in the enamel of teeth, producing microscopical fissures which constituted predisposing causes of caries, his remarks being published in the *Medical Times* and *Dental Cosmos*, and subsequently reprinted in the *London Microscopical Journal*. An interesting contribution (also illustrated by specimens) upon intermittent hæmaturia, from Dr. James Tyson, which likewise appeared in the *Medical Times*, and was republished by various



may serve as a subject for discussion, and render the proceedings, of sufficient value and interest to secure the general attendance of our own members as well as of other scientific men.

JOS. G. RICHARDSON, *Recorder*.

## REPORTS OF THE CONCHOLOGICAL SECTION.

### RECORDER'S REPORT.

The Recorder would respectfully report, that during the past year there have been elected three correspondents.

The deaths of the following members and correspondents have been announced: Charles W. Peale, member, October 5th; M. de la Saussaye, Bordeaux, correspondent, October 5th; F. F. Cavada, Cuba.

Twenty papers have been accepted for publication, by the following authors: W. Harper Pease, 6; Wm. H. Dall, 4; Bland and Binney, 4; Geo. W. Tryon, Jr., 3; R. E. C. Stearns, 2; F. B. Meek, 1.

Appended is a list of the correspondents elected during 1871.

Respectfully submitted by

S. R. ROBERTS, *Recorder*.

Correspondents elected in 1871:—

February 2d. H. E. Van Rijgersma, St. Martins, West Indies.

“ “ G. Nevill, Calcutta, India.

April 6th. Hugh Nevill, Point de Galle, Ceylon.

### CORRESPONDING SECRETARY'S REPORT.

To the Conchological Section of the Academy of Natural Sciences, Philadelphia:—

The Corresponding Secretary would respectfully report that letters have been written as follows, viz.:—

*Feb. 3.*—To Hugh Nevill, Galle, Ceylon.

To Dr. H. E. Van Rijgersma, St. Martins, W. I.

And letters have been received as follows, viz.:—

*March 14.*—From Albany Hancock.

*March 20.*—From H. E. Van Rijgersma.

*July 15.*—From Dr. Fred'k Stolzka.

*Nov. 3.*—From New York Lyceum of Natural History.

Smithsonian Institution, four letters.

1872.]



ANDREW J. GARRETT, of Papeiti, Tahiti. One hundred and fifty-four land, fresh-water, and marine shells of Polynesia, including types of many new species.

S. S. HALDEMAN. *Nautilus umibilicatus*, List.

J. GWYNN JEFFREYS. *Fusus Bernicensis*, King; *Lima excavata*, Chem., and eighteen other species of rare marine mollusca from Norway and Great Britain.

Dr. SAMUEL LEWIS, through W. L. MACTIER. Eggs of *Bulimus hæmastoma*.

W. HARPER PEASE. Thirty-six species of land and marine shells from the Pacific Islands.

SAMUEL POWEL. Egg-cases of *Fusus Islandicus*, from Newport, R. I.

J. H. REDFIELD. Eleven species of *Marginella*, mostly new to the collection; also twenty species of *bivalve mollusca*, new to the collection.

S. R. ROBERTS. Four species of *Clausilia* and one species of *Bulimus*, from Greece.

T. HALE STREETS. *Bulimus Powisianus*, from Isthmus of Te-hautepec.

GEO. W. TRYON, JR. Twenty species of *bivalve mollusca* new to the collection.

Dr. H. C. YARROW. Numerous specimens of *Lingula pyramidata*, Stimp., in alcohol. One hundred and fourteen species of shells from Beaufort, N. C.

WM. S. VAUX. Twenty-seven species of *Cypræa*, *Ovulum*, and *Solen* new to the collection.

One hundred species, numerous specimens of shells from Panama, including a number of species in alcohol, and fifty-six species from the coast of Nicaragua were presented by the subscribers to the McNeill Expedition to Central America.

Eighty-five species of Polynesian mollusca, principally new, collected by the Godeffroy Natural History Expedition, were purchased, together with thirty species of bivalve mollusca, new to the collection, and selected by the Rev. Dr. Beadle during his recent visit to London.

During the year the Committee on the Arrangement of the Cabinet, consisting of Messrs. Parker, Hassler, Roberts, Tryon, and Nolan, has cleaned, mounted, and labelled 6881 specimens in 1872.]

1898 trays. This includes the *Cardiidae*, *Lucinidae*, *Chamidae*, *Petricolidæ*, *Melanidae*, *Tridacnidae*, *Terebratulidae*, North American *Helices*, and *Corbiculadæ* in part. The current additions to the families already arranged have also been mounted and placed in the cases as soon as received.

The sale of duplicate specimens has furnished sufficient funds for the purchase of about sixty additional drawers, which have been procured and placed in the museum.

The total number of species mounted and arranged to date is 4081; number of trays and labels prepared, 7169; total number of specimens prepared and mounted, 20,941.

All of which is respectfully submitted,

EDWARD J. NOLAN, *Conservator*.

The election of Officers for the ensuing year was held, in accordance with the By-laws, with the following result:—

|                                |   |   |   |  |
|--------------------------------|---|---|---|--|
| <i>President</i>               | . | . | . | W. S. W. Ruschenberger, M.D.                             |
| <i>Vice-Presidents</i>         | . | . | . | Wm. S. Vaux.<br>Jos. Carson, M.D.                        |
| <i>Recording Secretary</i>     | . | . | . | Samuel B. Howell, M.D.                                   |
| <i>Corresponding Secretary</i> | . | . | . | Edward D. Cope.  |
| <i>Librarian</i>               | . | . | . | Edward J. Nolan, M.D.                                    |
| <i>Curators</i>                | . | . | . | Joseph Leidy, M.D.<br>Wm. S. Vaux.<br>Geo. W. Tryon, Jr. |

## ELECTIONS FOR 1871.

The following Members and Correspondents of the Academy of Natural Sciences have been elected during the year 1871 :—

## MEMBERS.

*February 28.*—Henry T. Peck, Archibald McIntyre, John McLaughlin, Lewis Thompson, George Thompson, Rachel L. Bodley, Lt. Clarence Edward Dutton, U.S.A., S. J. W. Mintzer, M.D., Elizabeth Shreve, J. B. White, M.D., Charles C. Phillips, Richard Morris Smith, T. Warren O'Neil, Charles T. Yerkes, Jr., Caleb Cresson, Wm. P. Jenks.

*March 28.*—Gustavus A. Nicholls, J. Price Wetherill.

*April 25.*—B. F. Quimby, A. Crawford Coates.

*May 30.*—Wm. Campbell Gatzmer, Samuel P. Wetherill.

*June 27.*—Frederick W. Endlich, Edward K. Williams, Frederick Gutekunst.

*November 28.*—Richard Day, Thomas E. Parke, M.D., Commodore J. P. Gillis, U.S.N., Samuel W. Pennypacker, Richard A. Lewis, W. Grier Hibler, Louis Stillé, M.D., James A. Ogden, Roland G. Curtin, M.D., Allen Shryock.

*December 26.*—A. L. Gihon, M.D., U.S.N., Andrew H. Miller.

## CORRESPONDENTS.

*February 28.*—S. B. Buckley, of Austin, Texas.

*March 28.*—Hon. H. Nevill, of Galle, Ceylon; John Hauxwell, of Pebas, Equador.

*June 27.*—Gen. L. E. Yorke, of Cincinnati, Ohio.

*November 28.*—Dr. J. Van A. Carter, of Fort Bridger, Wyoming; Dr. Joseph K. Corson, U.S.A.; Prof. W. C. Kerr, of Raleigh, N. C.; George Stewardson Brady, of Sunderland, England.

1

1

1

1

1

*June.*—Die Königliche Gesellschaft der Wissenschaften zu Göttingen, acknowledging receipt of publications.

Naturforschende Gesellschaft zu Halle a. d. S. ; with publications, and acknowledging receipt of publications.

Die Kaiserliche Akademie der Wissenschaften, Wien ; with publications.

*July.*—A. S. Herschel, announcing the death of Sir John Herschel.

Smithsonian Institution ;

Essex Institute ;

American Geographical and Statistical Society ; each acknowledging receipt of publications.

*August.*—Die Königl. böhmische Gesellschaft der Wissenschaften, Prag ; Secretär des Nassauischen Vereins für Naturkunde, Wiesbaden ; acknowledging receipt of publications.

Universidad de Chile ;

Fra Museets Direction, Bergen ;

Der Naturforscher Verein zu Riga ; with publications.

G. Burmeister, forwarding *Anales del Museo Publico de Buenos Aires*.

Madame Claparède, announcing death of Edward Claparède.

The Society of Natural and Physical Science, Leavenworth, asking for copy of Constitution and By-Laws of the Academy.

Consulat de Grèce, New York, regarding package sent.

Archivio per l'Antropologia E La Etnologia, proposing exchanges.

*September.*—Fra Museets Direction, Bergen ;

Naturhistorischer Verein der preussischen Rheinlande und Westphalens. Bonn ;

Geological Survey of India, Calcutta ;

Die Naturforschende Gesellschaft, Freiburg ; acknowledging receipt of publications.

Real Observatorio de Madrid ;

Geological Survey of India, Calcutta ;

Die Naturwissenschaftliche Gesellschaft zu Chemnitz ;

Italian Society of Natural Sciences, Milan ;

Société des Sciences de Finlande ; with publications.

Der Naturforschende Verein in Brünn, acknowledging receipt of publications, and forwarding others in return.

Hugh Nevill, acknowledging receipt of notice of election as correspondent.

*October.*—Naturforschende Gesellschaft in Emden ;

Der Naturwissenschaftliche Verein für das Fürstenthum Lüneburg ; each acknowledging receipt of publications.

William Garley, regarding fossils.

Prof. Gegenbauer, Jena ;

Société Linnéenne de Bordeaux ; with publications, and acknowledging receipt of others.

Die Kaiserliche Akademie der Wissenschaften, Wien, with publications.

1872.]

11

## DONATIONS TO THE LIBRARY, 1871.

## JOURNALS AND PERIODICALS.

## NORWAY.

- Bergen.** Sondre Bergenhus Amtsformandskabs Forhandlingar i Aaret 1867-70. From the Bergen Museum.
- Christiania.** Forhandlingar i Videnskabs-Selskabet. Aar 1869-70. From the Society.
- Det K. Norske Frederiks Universitets Aarsberetning for Aaret 1869-70. From the University.
- Nyt Magazin for Naturvidenskabernes. 7de Bind, 2et Hefte; 8de Bind, 3e Hefte. From the editors.
- Den Norske Turistforenings Arbog for 1870. From the Society.
- Norsk Meteorologisk Aarbog for 1869, 3die Aargang, 1870. From the Meteorologiske Instituut.
- Det Norske Meteorologiske Instituuts Storm-Atlas, 1870. From the Institute.

## DENMARK.

- Copenhagen.** Videnskabernes Meddelelser fra Naturhistorisk Forening for Aaret, 1870, No. 12-28. From the Society.
- Oversigt over det K. D. Videnskabernes Selskabs Forhandlingar og dets Medlemers Arbejder i Aaret, 1870, Nos. 2-3; 1871, No. 1. From the Society.
- Videnskabernes Selskab Skrifter, 5 Raekke, Naturvid, og Mathem. Afd. 9 Bd. II. III. and IV. From the Society.

## HOLLAND.

- Leeuwarden.** Nederlandsch Kruidkundig Archief. Vijde Deel, Vierde Stuk, 1870. From the editors.

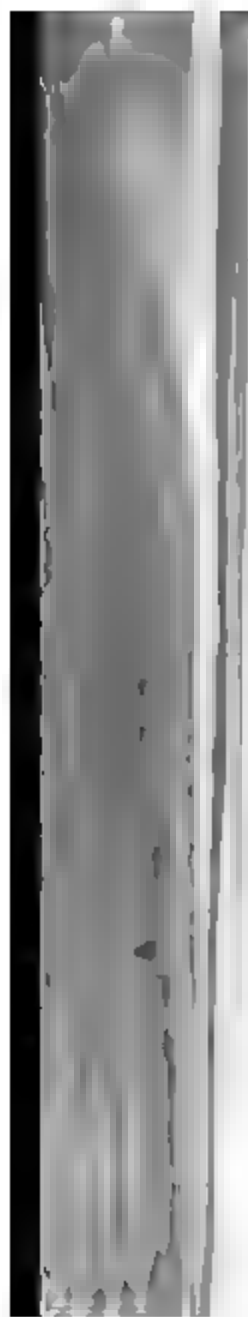
## RUSSIA.

- Dorpat.** Archiv für die Naturkunde Liv-Ehst und Kurlands. 1ste Series, 6er Band, 1ste Lief. 2e serie; 7er Band, 2e Lief. 1870. From the Publishing Society.
- Sitzungsberichte der Dorpater Naturforscher Gesellschaft, 3er Band, 1ste Hefte. From the Society.
- Helsingfors.** Acta Societatis Scientiarum Fennicae. Tomus IX. 1871. From the Society.
- Moscow.** Bulletin de la Société Impériale des Naturalistes de Moscou. Année, 1870, No. 2. From the Society.
- St. Petersburg.** Horæ Societatis Entomologicæ Rossicæ. Tome VI., No. 3 and supplement; Tome VII., Nos. 1-3; Tome VIII., No 1. From the Society.
- Mémoires de l'Académie Impériale des Sciences. 7e Série. Tome XVI., Nos. 1-8. From the Academy.
- Bulletin de l'Académie Impériale des Sciences. Tome XV., Nos. 3-5; Tome XVI., No. 1, 1871. From the Society.

1872.]



- Frankfurt, A. M. Bericht über die Senckenbergische Naturforschende Gesellschaft, 1869-70. From the Society.  
 Abhandlungen, herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft. 7ten Bandes, 3es und 4es Heft. From the Society.  
 Der Zoologische Garten. XI. Jahrg., Nos. 7-12; XII. Jahrg., Nos. 2-6. From the editor.
- Freiburg, J. B. Berichte über die Verhandlungen der Naturforschenden Gesellschaft. Heft III. and IV., 1870. From the Society.
- Göttingen. Nachrichten von der K. Gesellschaft der Wissenschaften und der Georg-Augusts Universität aus dem Jahre, 1870. From the Society.
- Halle. Abhandlungen der Naturforschenden Gesellschaft. 11ten Bandes, 2es Heft; 12ten Bandes, 1es und 2es Heft. From the Society.
- Hannover. Zwanzigster Jahresbericht der Naturhistorischen Gesellschaft. 1871. From the Society.
- Heidelberg. Verhandlungen des Naturhistorisch-Medicinischen Vereins. 5er Band. From the Society.
- Kärnten. Jahrbuch des Naturhistorischen Landesmuseum. 8 and 9 Heft. From the Society.
- Leipzig. Zeitschrift für Wissenschaftliche Zoologie. Vols 12, 13, 14, 15, and 21er Band, 1es-3es Heft. Purchased.  
 Jahrbuch für Wissenschaftliche Botanik. 17er Band, 4es Heft; 18 Band, 1es and 2es Heft. Purchased.  
 Jenaische Zeitschrift für Medicin und Naturwissenschaft. 6er Band, 1-4 Heft. From the Publishing Society.  
 Archiv für Anatomie, Physiologie, und Wissenschaftliche Medizin. 1869, No. I. to 1871, No. II. Purchased.  
 Journal für Ornithologie. XVIII. Jahrg., Heft IV. to XIX. Jahrg., Heft III. Purchased.  
 Berichte über die Verhandlungen der K. S. Gesellschaft der Wissenschaften. Mathematisch-Physische Classe. 1867, Nos. II-IV; 1870, Nos. I. and II. From the Society.  
 Abhandlungen of the same. IX. Band, Nos. IV. and V., 1870. From the Society.
- Munich. Sitzungsberichte der Math.-Phys., Classe der K. B. Akademie der Wissenschaften. 1870, II. Heft, 1-4; 1871, Heft I. and II. From the Society.
- Neubrandenburg. Archiv des Vereins der Freunde der Naturgeschichte in Meklenburg. 24 Jahr. From the Society.
- Pesth. Magyar Tudom. Akadémiai Almanach. 1869-70. From the Society.  
 A. M. T. Akadémia Erkönyvei Tizenharmadik Kötet. I and IV. Darab. From the Society.  
 Matematikai es Termeszettudományi Közlemények vonatkozólag a hazai viszonyokra. Kiadja A. M. T. Akadémia. V. Kötet. 1871. From the Society.  
 A. M. T. Akad. Értesítője. Második Evfolyam 12 Szam 1869—Negyedik Evfolyam, 11 Szam 1870. From the Society.  
 Ertezesek a Termeszettudományi Osztály Köréből. Kiadja a M. T. Akad. 1868-70. From the Society.
- Prag. Sitzungsberichte der K. B. Gesellschaft der Wissenschaften. Jahrg. 1870, Jan.—Dec. From the Society.  
 Abhandlungen of the same. 1870, 6ste Folge, 4er Band. From the Society.
- Regensburg. Flora, herausgegeben von der K. botanischen Gesellschaft. Neue Reihe, 28 Jahrg. From the Society.  
 Correspondenz-Blatt des Zoologisch-Mineralogischen Vereins. 2ter Jahrg. From the Society.
- 1872.]



## FRANCE.

- Bordeaux.** Mémoires de la Société des Sciences Physiques et Naturelles. Vols. VI. and VIII., 1er Cahier, 1868 and 1870. From the Society.
- Caen.** Mémoires de l'Académie Impériale des Sciences, Arts et Belles-Lettres. 1870 and 1871. From the Society.
- Lyons.** Mémoires de l'Académie Impériale des Sciences, Belles-Lettres, et Arts. Classe des Lettres. Tome 4me. 1868-69. From the Society.
- Annales de la Société Impériale d'Agriculture, Histoire Naturelle et Arts Utiles.** 4me Série. Tome 1er. 1868. From the Society.
- Paris.** Journal de Conchyliologie. 3e Série. Tome XI., Nos. 1-4. From the Editor.
- Annales des Mines.** 6me Série. Tome XVIII., 4e-6e Livr. 1871, e et 2e Livr. From the Minister of Public Works, France.
- Annales des Sciences Naturelles.** 5me Série. Botanique. Tome XII. Nos. 1-6. Zoologie. Tome XI. Nos. 1-6. Tome XIV. Purchased.
- Bulletin Mensuel de la Société Zoologique d'Acclimatation.** 2me Série. Tome VII., No. 8, to Vol. VIII., No. 10. From the Society.
- Bulletin de la Société Botanique de France.** Tome 17me. Comptes Rendus des Sciences, 2 and 3. 1870. From the Society.

## ITALY.

- Bologna.** Rendiconto delle Sessioni dell' Accademia delle Scienze dell' Istituto di Bologna. Anno Accademico, 1870-71. From the Society.
- Cagnola.** Atti della Fondazione Scientifica Cagnola. Vol. V., Pts. I. and II. From the Society.
- Lucca.** Atti della R. Accademia Lucchese di Scienza, Lettere ed Arti. Tomos 17 and 18. From the Academy.
- Milan.** Reale Istituto Lombardo di Scienze e Lettere. Rendiconti. Series II., Vol. II., Fasc. 17 *et seq.* Vol. III. and IV., Fasc. 1-6, 8-13. From the Academy.
- Memoirs of the same.** Classe di Scienze Matematiche e Naturale. Vol. XII. From the Society.
- Napoli.** Società Reale di Napoli. Atti dell' Accademia delle Scienze Fisiche e Matematiche. Vols. III. and IV. From the Society.
- Rendiconto of the same.** Anno VI., Nos. 6-12. Anno VII. and VIII. From the Society.
- Palermo.** Giornale di Scienze Naturali ed Economiche pubblicato per cura del Consiglio di Perfezionamento annesso al R. Istituto Tecnico di Palermo. Anno 1869. Vol. V., Fasc. III. and IV. Anno 1870. Vol. VI., Fasc. I. and II. From the Society.
- Turin.** Atti della R. Accademia delle Scienze di Torino. Vol. V., Disp. 1e-7e, 1870. From the Society.
- Notizia Storico dei Lavori fatti della Classe di Scienze fisiche e Matematiche dell' R. Accademia delle Scienze di Torino negli Anni 1864 e 1865.** From the Academy.
- Appendice al Vol. IV. degli Atti della R. Accademia delle Scienze di Torino.** From the Society.
- Bulletino Meteorologico ed Astronomico del Regio Osservatorio dell' Università di Torino.** Anno IV., 1869. From the University.
- Venice.** Atti del Reale Istituto Veneto di Scienze, Lettere ed Arti. Tome 14, Disp. 10; Tome 15, Disp. 1, 3-10; Tome 16, Disp. 1-7. From the Society.



## UNITED STATES.

- Baltimore.** Fourth Annual Report of the Provost to the Trustees of the Peabody Institute of the City of Baltimore. June 1, 1871. From the Trustees.
- Boston.** Annual Report of the Trustees of the Museum of Comparative Zoology at Harvard College, for 1870. From the Trustees.  
 Bulletin of the same. Vol. III., No. 1.  
 Fourth and Fifth Annual Reports of the Trustees of the Peabody Museum of American Archæology and Ethnology. 1871. From the Trustees.  
 The Literary World. Vol. I., No 89 to Vol. II., No. 1. From the Editor.  
 Proceedings of the Boston Society of Natural History. Vol. XIII., Page 303 *et seq.*; Vol. XIV. Pages 1-112. From the Society.  
 • Memoirs of the Boston Society of Natural History. Vol. II., Part I., No. 2. From the Society.  
 Annual of Scientific Discovery for 1868 to 1871. Purchased.
- Cambridge.** Bulletin of the Museum of Comparative Zoology. Vol. II., Nos. 2 and 3. From the Director.
- Chicago.** American Journal of Microscopy. Vol. I., No. 1. April, 1871. From the Editor.
- Harrisburg.** Pennsylvania Fruit Grower's Society. Annual Meeting. January 6, 1867. From the Society.
- Leavenworth Medical Herald.** Vol. IV., No. XII. to Vol. V., No. XI. From the Editor.
- New Haven.** The American Journal of Science and Arts. 1871. Vol. I., No. 1 to Vol. II., No. 12. Third Series. From the Editors.  
 Transactions of the Connecticut Academy of Arts and Sciences. Vol. I., Part 2. From the Society.
- Newport.** Archives of Science and Transactions of the Orleans County Society of Natural Sciences. Vol. I., Nos. 2-4. From the Editor.
- New York.** Bulletin of the Torrey Botanical Club. Vol. I., No. 12 to Vol. II., No. 11. From Thos. Meehan.  
 The American Gas Light Journal. Vol. XIII., No. 1 to Vol. XIV., No. 6. From the Editor.  
 New York Medical Journal. Vol. XIII., No. 2 to Vol. XIV., No. 6. From the Editor.  
 The American Chemist. New Series. Vol. I., No. 7 to Vol. II., No. 5. From the Editor.  
 Annals of the Lyceum of Natural History. Vol. IX., No. 13 to Vol. X., No. 3. From the Society.
- Philadelphia.** American Journal of Conchology. Vol. IV., Part 3 to Vol. VII., Part 2. From the Publication Committee.  
 The Dental Cosmos. Vol. XIII., Nos. 1-12. From the Editor.  
 The Gardener's Monthly. Vol. XIII., Nos. 1-12. From the Editor.  
 The Penn Monthly. Vol. II., Nos. 1-12. From the Editor.  
 American Journal of Pharmacy. Vol. XLIII., Nos. 1-12. Fourth Series. From the Editor.  
 Proceedings of the American Pharmaceutical Association at the 18th Annual Meeting. September, 1870. From the Association.  
 The American Journal of the Medical Sciences. Nos. 121-124. From the Editor.  
 Journal of the Franklin Institute. Vol. XCII., Nos. 546-550. From the Institute.  
 Proceedings of the American Philosophical Society. Vol. XI., No. 85 and Vol. XII., No. 86. 1870. From the Society.  
 Transactions of the same. Vol. XIV. New Series, Part 1. From the Society.

- Salem.** The American Naturalist. Vol. V., Nos. 2-11. From the Editor.  
 Bulletin of the Essex Institute. Vol. II., No. 9 to Vol. III., Nos. 1, 3, 5-7. From the Society.  
 Proceedings and Communications of the Essex Institute. Vol. VI, Part 2. From the Society.  
 Memoirs of the Peabody Academy of Sciences. Vol. I., No. 2. From the Academy.  
 Second and Third Annual Reports of the Trustees of the Peabody Academy of Sciences, for the years 1869 and 1870. From the Trustees.
- St. Louis.** American Entomologist. Vol. II., No. 12. Purchased.
- San Francisco.** Proceedings of the California Academy of Sciences. Vol. IV., Part 3. 1870. From the Society.  
 California Farmer, for 1871. From the Editor.
- Washington.** Smithsonian Contributions to Knowledge. Vol. XXVII. From the Smithsonian Institution.
- Worcester.** Proceedings of the American Antiquarian Society. No. 56, and October 21, 1870. From the Society.

## CANADA.

- Montreal.** The Canadian Naturalist. New Series. Vol. V., Nos. 2-4, and Vol. VI., No. 1. From the Editor.  
 The Year Book and Almanac of Canada, for 1871. From P. P. Carpenter.
- London, Canada.** Canadian Entomologist. Vol. II., Nos. 10-12. Vol. III., Nos. 1-8. From the Editor.
- Quebec.** Transactions of the Literary and Historical Society. New Series. Part 8. From the Society.
- Toronto.** The Canadian Journal of Science, Literature, and History. Vol. XIII., Nos. 1 and 2. From the Editor.

## SOUTH AMERICA.

- Buenos Aires.** Anales del Museo Publico de Buenos Aires. Entrega 4 and 5. From the Museum.
- Santiago de Chile.** Anales de la Universidad de Chile. Jan.-Dec. 1869. From the University.

## OTHER SCIENTIFIC WORKS.

- Accessions to the Indian Museum, Calcutta, from June, 1869, to June, 1870.**  
From Dr. Joseph Leidy.
- Aeby, Dr. Chr.** *Der Bau des Menschlichen Körpers.* Leipzig, 1871.  
Purchased.
- Agassiz, L., and Ch. F. Hart.** *Scientific Results of a Journey in Brazil.*  
Boston, 1870. Purchased.
- Allman, Geo. James.** *Publications of the Ray Society. A Monograph of the Gymnoblastic or Tubularian Hydroids. Part I.* From the Wilson Fund.
- Annual Report of the Secretary of the Interior for the year 1871.** From the Author.
- Annual Report of the Directors of City Trusts for the year 1870.** First.  
From the Board of Trusts.
- Annual Report of the Regents of the University of the State of New York.** Twentieth. Revised edition, 1868. From James Hall.
- Annual Report of the N. Y. State Library.** Fifty-third. From the Trustees.
- Annual Report of the Commissioners of Fisheries of the State of New Jersey, 1870.** First. From the Commissioners.
- Annual Report of the Board of Commissioners of Public Charities of the State of Pennsylvania, 1871.** First. From the Board.
- Annual Report of the Secretary of the Treasury on the state of the Finances for the year 1870.** From the Secretary.
- Baars, Herman.** *Les Pêches de la Norwège.* From the Author.
- Baird, S. F., and J. G. Cooper.** *Geological Survey of California. Ornithology. Vol. I., Land Birds.* Purchased.
- Bericht über die Wissenschaftlichen Leistungen im Gebiete der Entomologie während der Jahre 1867, 1868.** 1ste und 2e Hälfte, und 1869.  
Purchased.
- Bischoff, G.** *Lehrbuch der Chemischen und Physikalischen Geologie.* 3 Vols. Bonn, 1863, 1866. Purchased.
- Bland, Thos. and W. G. Binney.** *Notes on the genus Pineria and on the lingual dentition of Pineria Viequensis Pfr.* From the Authors.
- Bleeker, P.** *Atlas Ichthyologique des Indes Orientales Néerlandaises.* Livrs 22-24. From the Wilson Fund.
- Bocage, J. V. Barboza du.** *Oiseaux nouveau de l'Afrique occidentale.* From the Author.
- Bolton, J. C.** *Index to the Literature of Uranium.* From the Author.
- Brady, George Stewardson.** *A Review of the Cyprinidæ of the European Seas.*  
*Notes on Fossil Ostracoda.*  
*The Ostracoda and Foraminifera of Tidal Rivers.*  
*Address to the Members of the Tyneside Naturalist's Field Club.*  
*On undescribed fossil Entomostraca from the brick-earth of the Nar.*  
*Deep-Sea Dredging on the Coasts of Northumberland and Durham in 1864.*  
*Contributions to the Study of the Entomostraca.*  
*Notes of week's dredging in the west of Ireland.*  
*On the Crustacean Fauna of the salt marshes of Northumberland and Durham.*  
*Description of an Entomostracan inhabiting a Coal Mine.*  
*Notes on Entomostraca.* From the Author.
- Brady, Henry B.** *On Saccamina Carteri.*  
*On Ellipsoidina.* From the Author.

- Brigham, W. T. Historical Notes on the Earthquakes of New England, 1838-1869. From the Author.
- Bronn, Dr. H. G. Klassen und Ordnungen des Thier-Reichs. 6er Band, IV. Abth, 5 and 5 Lief; 5er Band, 14er, 15er, und 16er Lief. From the Wilson Fund.
- Capellini, Prof. Cav. G. Di Nicola Stenone e dei suoi Studii geologici in Italia.  
Armi e Utensili di Pietra del Bolognese.  
Cenni Geologici sulle valli del' Ufita del Calore e del Cervaro. Bologna, 1869.  
L'Eta della Pietra nella valle della vibrata del Prof. Cav. G. Capellini. Bologna, 1871. From the Author.
- Capello, Felix de Bristo. Algumas especies novas ou pouco conhecidas de Crustaceos pertencentes aos generos Calappa e Telphusa. From the Author.
- Catalogue of Scientific Papers published by the Royal Society. Vol. IV. London, 1870. From the Society.
- Catalogues of the Library and of the Numismatic and Ethnological Collections of the Society of Arts and Sciences of Batavia. From the Society.
- Carpenter, Wm. B. and H. B. Brady. Description of Parkeria and Loftusia. From the Authors.
- Colding, M. A. Extrait d'un Mémoire sur les Loix des Courants dans les Conduits ordinaires et dans la Mer. From the Author.
- Collection of thirty-eight schoolbooks, tales, and translations. From the Museum at Bergen.
- Cook, George H. Annual Report of the State Geologist of New Jersey for the year 1870. From the Author.
- Cope, E. D. On the Homologies of some of the Cranial Bones of the Reptilia, and on the systematic arrangement of the class.  
Second Addition to the history of the Fishes of the Cretaceous of the U. S.  
Fourth Contribution to the history of the Fauna of the Miocene and Eocene Periods of the United States. From the Author.
- Cones, E. On the Myology of the Ornithorynchus. From the Author.
- Credner, H. Ueber gewisse Ursachen der Krystallverschiedenheiten des kohlensauren Kalkes.  
Ueber nordamerikanische Schieferporphyroide

- Emmons, E.** Natural History of New York. Agriculture, Vol. 3. Purchased.
- Emory, W. H.** Report on the United States and Mexican Boundary Survey. Vol. I., Part II. From Jas. Hall.
- Erco, Richard Ritter von.** Notizen über Austern-Culter. Triest, 1869. Purchased.
- Ewald, J., J. Roth, und H. Eck.** Leopold von Buch's gesammelte Schriften. 2er Band. Berlin, 1870. Purchased.
- Finsch, Dr. O.** Monographie der Gattung Certhiola. From the Author.
- Flower, Wm. H.** An Introduction to the Osteology of the Mammalia. London, 1870. From Jos. Jeanes.
- Fifty-eight** bibliographical pamphlets, publishers' lists, college catalogues, etc. From the Publishers.
- Frauenfeld, Geo. R. v.** Ueber Vertilgung des Rapskäfers.  
Ueber den Wert der Vogel in Bezug auf das Vogelschutzgesetz.  
Kurzer Bericht der Ergebnisse meines Ausfluges von Heiligenblut über Agram an den Plattensee.  
Die Ausgestorbenen und Aussterbenden Thiere der jungsten Erdperiode. From the Author.
- Fritsch.** Phänologische Beobachtungen aus dem Pflanzen- und Thierreiche. VIII., Heft. Jahrg. 1857. From the Vienna Academy.
- Gaudry, A.** Animaux Fossiles et Geologie de l'Attique. 16-19 Livr. Purchased.
- Memoirs of the Geological Survey of India.** Vol. VII., Parts 1, 2, and 3.
- Palæontologia Indica.** Cretaceous Fauna of Southern India. Vol. III., Nos. 1-8.
- Geological Survey of India, Records of the.** Vol. II., Parts 2, 3, and 4. Vol. III. and Vol. IV., Parts 1 and 2. From the Survey.
- Gmelin, J. G.** Joannis Georgii Gmelini, Reliquias quæ supersunt Commercii Epistolici cum Carolo Linnæo, Alberto Hallero, Guilielmo Stellero, et al. From the Editor, Dr. G. H. T. Plieninger.
- Gray, Geo. R. Hand.** List of Genera and Species of Birds. Part II. From the Author.
- Grote, A. R.** On Thecla inornata, G. and R., and Thecla falacer, Godt. From the Author.
- Gunther, A. C. L. G.** The Record of Zoological Literature. 1869. Vol. VI. London, 1870. Purchased.
- Hall, Jas.** Natural History of New York. Palæontology, Vols. III. and IV. Purchased.  
Contributions to Palæontology. Genus Eurypteris.  
Geological Survey of the State of Wisconsin. 1859-1863. Palæontology. Part 3.  
Natural History of New York. Part VI. Palæontology. Vol. IV. From the Author.
- Hanley, S. and Wm. Theobald.** Conchologia Indica. Part 2. Purchased.
- Hansen, G. A.** Foreløbige Bidrag til Spedalskhedens Karakteristik.  
Fortsatte Bidrag til Lepraens (Spedalskhedens) Karakteristik. From the Author.
- Hague, Jas. D.** United States Geological Exploration of the Fortieth Parallel. Mining Industry. With Atlas. From the Chief of Engineers, U. S. A.
- Hayden, F. V.** Preliminary Report of the United States Geological Survey of Wyoming. From the Author.
- Henry, Joseph.** Smithsonian Miscellaneous Collection. 237. Directions for Constructing Lightning Rods. From the Smithsonian Institution.
- Hewitson, W. C.** Exotic Butterflies. Parts 75-80. From the Wilson Fund.

Hogg, Jabez. On Gnat Scales.

The Fungoid Origin of Disease and Spontaneous Generation.

Mycetoma: the Madura or Fungus-foot of India. From the Author.

Hunter, Jas. B. A Review of Darwin's Theory of the Origin and Development of Man. From the Author.

Isael, A. Biblioteca Malacologica. Malacologia del Mar Rosso ricerche Zoologiche e Paleontologiche. Purchased.

James, T. P. Catalogue of Muscl. From the Author.

Jan, Prof. Iconographie Générale des Ophiidiens. 36me Livr. From the Wilson Fund.

Keyserling, E. Beschreibungen neuer und wenig bekannter Arten aus der Familie Orbitelae, Latr. From Dr. H. C. Wood, Jr.

Kile, O. H. Address delivered before the Pawcotuck Library Association. From the Author.

Kingston, G. T. On the Diurnal and Annual Variations of Temperature at Halifax. From the Author.

Kjerulf, Prof. Th. Om Skuringemaerker. From the Author.

Kortfattet, Statistisk Haandbog over Kongeriget Norges Inddelinger i Administratio, restslig og geistlig Henseende, M.M. From the Bergen Museum.

Kuster, H. C. Systematisches Conchylien-Cabinet von Martini und Chemnitz. 10er Band, Heft VIII.-XII. 3er Band, 29 Heft. From the Wilson Fund.

Lacordaire, M. Th. Nouvelles Suites a Buffon. Histoire Naturelle des Insects, Genera des Coléoptères. Tome 9me, 1re Partie. From the Wilson Fund.

Lawes, J. B. Exhaustion of the Soil in relation to Landlords' Covenants and the Valuation of Unexhausted Improvements.

Memoranda of the Plan and Results of Field Experiments.

Effects of the Drought of 1870 on some of the Experimental Crops at Rothamsted.

Scientific Agriculture, with a View to Profit. From the Author.

Lea, Isaac. Extra Sheets of Lea's Synopsis of the Genus Unio, for Labelling. From the Author.

Lyell, Chas. A number of copies of a reprint on the Oolite Field of Virginia. From Col. Jas. Greer.

Lyman, B. S. General Report on the Punjab Oil Lands, with Chart. Lahore. 1870. From the Author.

- Morgan, Lewis H.** Smithsonian Contributions to Knowledge. Vol. XXVII. Systems of Consanguinity and Affinity of the Human Family. From the Smithsonian Institution.
- Morren, Ch.** Dodonæa. Parts 1 and 2. From Dr. H. C. Wood, Jr.
- Morse, Edw. S.** On the Early Stages of *Terebratulina septentrionalis*. From the Author.
- Museo Nacional de Lisboa.** Seccao Zoologica. Catalogo das Collecções Ornithologicas. Psittaci, Accipitres. From the Museum.
- Mueller, Dr. C.** Walpers. Annales Botanices Systematicæ. Tomi Septimi. Fasc. V. VI. From the Wilson Fund.
- Naumann, Dr. C. F.** Anfangsgründe der Krystallographie. Leipzig, 1854.  
Elemente der theoretischen Krystallographie. Leipzig, 1856.  
Elemente der Mineralogie. Leipzig, 1871.
- Neville, G. & H.** Descriptions of new Mollusca from the Eastern Regions. From the Authors.
- Neville, H.** Enumeratio Heliceorum et Pneumonopomorum Insula "Ceylon" adhuc detectorum. From the Author.
- Newberry, J. S.** Geological Survey of Ohio. 1869. Parts 1, 2, 3. From the Author.
- Ninth Census of the United States.** Statistics of Population. From the Department of the Interior.
- Olney, S. T.** Algæ Rhodiaceæ and Carices Boreali-Americanæ. Providence, 1871. From the Author.
- Packard, A. S.** First Annual Report on the Injurious and Beneficial Insects of Massachusetts. From the Author.
- Paetel, Fr.** Molluscorum Systema et Catalogus System und Aufzählung sämtlicher Conchylien der Sammlung. Dresden, 1869. From Dr. L. W. Schaufuss.
- Peters, Dr. W.** Lista de Mammiferos das possessões portuguezas da Africa occidental e diagnoses de algumas especies novas. From the Author.
- Pfeiffer, L., Dr. W. Dunker, and Dr. E. Römer.** Novitates Conchologicæ. I. Abth, Land-Conchylien. 37, 38, und 39 Lief. II. Abth, Meeres-Conchylien. 16 Lief. Supplement III. Monographie der Molluskengattung Venus. 26-33 Lief. From the Wilson Fund.
- Playfair, Lieut.-Col., R. L. and A. C. L. G. Günther.** The Fishes of Zanzibar. London, 1866. From Col. Playfair.
- Pleasanton, Gen. A. J.** On the Influence of the Blue Color of the Sky in Developing Animal and Vegetable Life. From the Author.
- Polli, Prof. John.** Observations on the Treatment of Zymotic Diseases by the Administration of Sulphites. From the Author.
- Putnam, F. W.** Note on the Young of *Orthagoriscus mola*. From the Author.
- R. Comitato Geologico d'Italia.** Bollettino. Nos. 9 e 10. Anno 1870. Nos. 1-6. 1871. From the Survey of Italy.
- Reeve, L.** Conchologia Iconica. Parts 284-289. From the Wilson Fund.
- Report of the Fruit Growers' Association of Ontario, for the Year 1870.** Toronto. From the Association.
- Report of the Librarian of Congress.** 1870. From the Author.
- Robeson, G. M.** Instructions for the Expedition towards the North Pole. From Prof. Henry.
- Rolle, Dr. F.** Der Mensch, seine Abstammung und Gesittung im Lichte der Darwin'schen Lehre. Prag, 1870. From Dr. Henry C. Chapman.
- Ross, Alex. M.** Catalogue of the Birds, Insects, and Squirrels collected in the Vicinity of Toronto, Canada. From the Author.
- Rothrock, H. P.** Map of Wyandotte Cave, Crawford County, Indiana. From the Proprietor.
- Safford, Jas. M.** Geology of Tennessee. Nashville, 1869. Purchased. 1872.]

- Sars, G. O. Carcinologiske Bidrag til Norges Fauna. From the Author.
- Schäufuss, Dr. L. W. Zoologische Mittheilungen. From the Author.
- Seguin, M. Aine. Mémoire sur les Causes et sur les Effets de la Chaleur de la Lumière et de l'Electricité. From the Author.
- Mémoire sur l'Aviation ou Navigation Aérienne. From the Author.
- Seue, C. de. Le Névé de Justedal et ses Glaciers. From the Author.
- Sharpe, R. B. A Monograph of the Alcedinidae or Kingfishers. Parts I. to XV. From the Author.
- Smith, Green. Two Charts representing the present generally adopted method of classifying Birds. From the Author.
- Smith, T. Guilford. Report of the Mineral Lands and Resources of the Alabama and Chattanooga Railroad Company. From the Author.
- Sobrero, A. Notizia Storica dei lavori fatti della Classe di Scienze fisiche e Matematiche della R. Accademia delle Scienze di Torino. Negli Anno 1864 e 1865. From the Academy.
- Souverbie et Montrouzier, M.M. Descriptions d'espèces nouvelles de l'Archipel Calédonien. From the Author.
- Sowerby, G. B. Thesaurus Conchyliorum. Parts XXVI.-XXIX. A Monograph of the Genus *Cyprea*. Purchased.
- Stalnton, H. T. The Natural History of the Tineina. Vol. XII. From the Wilson Fund.
- Stearns, R. E. C. Conchological Memoranda. No. VI. From the Author.
- Stimpson, W. The Crustacea and Echinodermata of the Pacific Shores of North America. From Dr. H. C. Wood, Jr.
- Sveriges Geologiska Undersökning. Parts 36-41. With Six Maps. From the Geological Survey of Sweden.
- Thlolliere, V. Description des Poissons Fossiles provenant des Gisements Coralliens du Jura dans le Bugey. 1re Livr. Purchased.
- Troschel, Dr. F. H. Das Gebiss der Schnecken. 2en Bandes, 3e Lief. Berlin, 1869. Purchased.
- Tuomey, M. Second Biennial Report on the Geology of Alabama. Geological Map. From T. Guilford Smith.
- Twenty-five duplicate pamphlets on Entomology, Botany, and Geology. From Dr. H. C. Wood, Jr.
- Walker, Francis. Notes on Chalcididae. Parts III. and IV. From the Author.
- A list of Hymenoptera collected by J. K. Lord, in Egypt, in the neighborhood of the Red Sea, and in Arabia. From the Author.
- Wallace, Alfred R. The Malay Archipelago. New York, 1869. Pur-

## INDEX TO GENERA.

|                           |                         |                              |               |
|---------------------------|-------------------------|------------------------------|---------------|
| <b>Abies</b> .....        | 107                     | <b>Arca</b> .....            | 129, 132      |
| <b>Abra</b> .....         | 138                     | <b>Archæscaris</b> .....     | 385           |
| <b>Acara</b> .....        | 255                     | <b>Arenæus</b> .....         | 121           |
| <b>Accipiter</b> .....    | 27                      | <b>Arctomys</b> .....        | 230           |
| <b>Acer</b> .....         | 101                     | <b>Ardea</b> .....           | 33            |
| <b>Achelous</b> .....     | 120                     | <b>Aspidium</b> .....        | 53            |
| <b>Achillea</b> .....     | 116                     | <b>Astarte</b> .....         | 134           |
| <b>Achrochordus</b> ..... | 202                     | <b>Asterias</b> .....        | 148           |
| <b>Actæa</b> .....        | 239                     | <b>Atelopus</b> .....        | 205, 222      |
| <b>Actodromas</b> .....   | 30                      | <b>Aulastomum</b> .....      | 306           |
| <b>Acus</b> .....         | 144                     | <b>Avicula</b> .....         | 133           |
| <b>Æcidium</b> .....      | 296                     | <b>Aviculopecten</b> .....   | 60, 161, 178  |
| <b>Ægialitis</b> .....    | 28                      | <b>Aythya</b> .....          | 87            |
| <b>Agalychnis</b> .....   | 205                     |                              |               |
| <b>Agelæus</b> .....      | 24                      | <b>Baena</b> .....           | 228           |
| <b>Agrostis</b> .....     | 116                     | <b>Balæna</b> .....          | 13            |
| <b>Aix</b> .....          | 36                      | <b>Balanus</b> .....         | 125           |
| <b>Alligator</b> .....    | 48                      | <b>Bascanion</b> .....       | 49            |
| <b>Allorisma</b> .....    | 70, 167                 | <b>Bellerophon</b> .....     | 77            |
| <b>Alpheus</b> .....      | 242                     | <b>Bernicla</b> .....        | 36            |
| <b>Alyssum</b> .....      | 111                     | <b>Bittium</b> .....         | 142           |
| <b>Amblyopsis</b> .....   | 297                     | <b>Botaurus</b> .....        | 34            |
| <b>Ambonychia</b> .....   | 319                     | <b>Bothriechis</b> .....     | 204, 206, 207 |
| <b>Ambrosia</b> .....     | 110                     | <b>Bothriocephalus</b> ..... | 306           |
| <b>Amia</b> .....         | 105                     | <b>Bothriopsis</b> .....     | 206, 208      |
| <b>Amiva</b> .....        | 216, 218, 220, 221, 222 | <b>Bothrops</b> .....        | 204           |
| <b>Ammodromus</b> .....   | 22                      | <b>Bouvardia</b> .....       | 52            |
| <b>Amphidesma</b> .....   | 128, 138                | <b>Brachyotus</b> .....      | 27            |
| <b>Anacyrtus</b> .....    | 266                     | <b>Branchiostoma</b> .....   | 129           |
| <b>Analís</b> .....       | 205                     | <b>Brochis</b> .....         | 112, 277, 291 |
| <b>Anaphthalmus</b> ..... | 297                     | <b>Brycon</b> .....          | 261           |
| <b>Anas</b> .....         | 36                      | <b>Bucephala</b> .....       | 37            |
| <b>Ancistrodon</b> .....  | 48, 205, 206, 209       | <b>Bufo</b> .....            | 205, 216, 219 |
| <b>Anchitherium</b> ..... | 118, 199                | <b>Bulla</b> .....           | 140           |
| <b>Aniculus</b> .....     | 240                     | <b>Busycon</b> .....         | 129, 144      |
| <b>Anodonta</b> .....     | 188                     | <b>Butorides</b> .....       | 33            |
| <b>Anolis</b> .....       | 200, 213, 218, 220      |                              |               |
| <b>Anomia</b> .....       | 131                     | <b>Cacabocrinus</b> .....    | 59            |
| <b>Anosteira</b> .....    | 102, 114                | <b>Calidris</b> .....        | 31            |
| <b>Anostomus</b> .....    | 258                     | <b>Callichthys</b> .....     | 275, 277      |
| <b>Anser</b> .....        | 98                      | <b>Callinectes</b> .....     | 120           |
| <b>Anthus</b> .....       | 19                      | <b>Callophysus</b> .....     | 292           |
| <b>Aphyocharax</b> .....  | 260, 291                | <b>Caloptenus</b> .....      | 149           |
| <b>Aplysia</b> .....      | 140                     | <b>Camilia</b> .....         | 200           |
| <b>Aralia</b> .....       | 106                     | <b>Campeloma</b> .....       | 181           |

1872.]

|                   |          |                    |               |
|-------------------|----------|--------------------|---------------|
| Cancellaria.....  | 146      | Conophis.....      | 204           |
| Cancer.....       | 120      | Contia.....        | 229           |
| Caprifolium.....  | 107      | Conularia.....     | 84            |
| Carapus.....      | 257      | Convolvulus.....   | 117           |
| Cardinalis.....   | 24       | Corbula.....       | 139           |
| Cardiomorpha..... | 72, 327  | Corydoras.....     | 112, 277, 278 |
| Cardita.....      | 134      | Corythophanes..... | 200           |
| Cardium.....      | 134      | Corvus.....        | 26            |
| Cariacus.....     | 13       | Cotyle.....        | 21            |
| Carpilius.....    | 239      | Cratægus.....      | 107           |
| Cassia.....       | 117      | Crenicichla.....   | 252           |
| Cassis.....       | 143      | Crepidula.....     | 140           |
| Cathartes.....    | 27       | Crocodylus.....    | 104           |
| Catherpes.....    | 233      | Cumingia.....      | 138           |
| Catostoma.....    | 212      | Curimatus.....     | 256, 291      |
| Caudisoma.....    | 48, 204  | Cyclonema.....     | 79            |
| Cauloxenus.....   | 297      | Cyclura.....       | 205, 216      |
| Cenobita.....     | 241      | Cypræa.....        | 143           |
| Ceratiocaris..... | 332      | Cypricardina.....  | 162           |
| Cercis.....       | 106      | Cyrtoceras.....    | 86            |
| Cercomya.....     | 71       | Cythere.....       | 331           |
| Cerithiopsis..... | 144      | Cytherea.....      | 136           |
| Cerithium.....    | 141      |                    |               |
| Ceromya.....      | 328      | Dafila.....        | 36            |
| Ceromyopsis.....  | 328      | Dalmanites.....    | 91            |
| Ceryle.....       | 26       | Delphinus.....     | 18            |
| Cetopsis.....     | 292      | Dendroeca.....     | 21            |
| Chærostoma.....   | 280      | Deutzia.....       | 53            |
| Chalceus.....     | 262      | Dianema.....       | 112, 276, 291 |
| Chalcinus.....    | 265      | Dibothrium.....    | 306           |
| Chama.....        | 134      | Didelphys.....     | 15            |
| Characidium.....  | 259, 291 | Dionæa.....        | 118           |
| Charadrius.....   | 28       | Diplacus.....      | 157           |
| Chauliastmus..... | 36       | Diplodonta.....    | 134           |
| Chelonia.....     | 49       | Dipsas.....        | 204           |
| Chersydrus.....   | 202      | Dolabra.....       | 326           |
| Chettusia.....    | 194      | Dolatocrinus.....  | 57            |
| Chione.....       | 136      | Dolichonyx.....    | 24            |

|                             |          |                            |              |
|-----------------------------|----------|----------------------------|--------------|
| <b>Eulima</b> .....         | 142      | <b>Hybemys</b> .....       | 103          |
| <b>Eupagurus</b> .....      | 124      | <b>Hydrochelidon</b> ..... | 46           |
| <b>Euphorbia</b> .....      | 296      | <b>Hydrolycus</b> .....    | 292          |
| <b>Falco</b> .....          | 27, 94   | <b>Hydrops</b> .....       | 216, 217     |
| <b>Fasciolaria</b> .....    | 147      | <b>Hygrogonus</b> .....    | 256, 291     |
| <b>Fenestella</b> .....     | 159      | <b>Hyla</b> .....          | 49, 219, 222 |
| <b>Fiber</b> .....          | 14       | <b>Hyperanodon</b> .....   | 222          |
| <b>Fissurella</b> .....     | 141      | <b>Ilyosaurus</b> .....    | 104          |
| <b>Fraxinus</b> .....       | 110, 245 | <b>Hypsirhynchus</b> ..... | 218          |
| <b>Fulix</b> .....          | 37       | <b>Hyrachyus</b> .....     | 229          |
| <b>Fundulus</b> .....       | 217      | <b>Ilyracodon</b> .....    | 229          |
| <b>Galeodes</b> .....       | 295      | <b>Icterus</b> .....       | 24           |
| <b>Gallinago</b> .....      | 30       | <b>Iguanodectes</b> .....  | 260, 291     |
| <b>Gambetta</b> .....       | 32       | <b>Ilyonassa</b> .....     | 143          |
| <b>Gasteropelecus</b> ..... | 265      | <b>Isocardia</b> .....     | 183          |
| <b>Gastrochaena</b> .....   | 139      | <b>Isonema</b> .....       | 79           |
| <b>Garzetta</b> .....       | 33       | <b>Itea</b> .....          | 107          |
| <b>Gebia</b> .....          | 242      | <b>Læmolyta</b> .....      | 258          |
| <b>Gelasimus</b> .....      | 121      | <b>Lagopus</b> .....       | 96           |
| <b>Gemma</b> .....          | 136      | <b>Laris</b> .....         | 108          |
| <b>Geophagus</b> .....      | 250, 291 | <b>Larus</b> .....         | 39           |
| <b>Geothlypis</b> .....     | 20       | <b>Lasiurus</b> .....      | 14           |
| <b>Gleditschia</b> .....    | 106, 107 | <b>Leda</b> .....          | 133          |
| <b>Glyptocrinus</b> .....   | 314      | <b>Lepidosteus</b> .....   | 105          |
| <b>Glyptosaurus</b> .....   | 105      | <b>Leporinus</b> .....     | 259          |
| <b>Goniodactylus</b> .....  | 200, 222 | <b>Leptopphis</b> .....    | 49           |
| <b>Gordius</b> .....        | 306      | <b>Leptodira</b> .....     | 204          |
| <b>Graculus</b> .....       | 38       | <b>Leptognathus</b> .....  | 204          |
| <b>Grammysia</b> .....      | 72       | <b>Lepus</b> .....         | 14, 96       |
| <b>Grapsus</b> .....        | 240      | <b>Libinia</b> .....       | 120          |
| <b>Gymnocladus</b> .....    | 106      | <b>Lilium</b> .....        | 117          |
| <b>Gyroceras</b> .....      | 87       | <b>Lima</b> .....          | 131          |
| <b>Hadrohyus</b> .....      | 248      | <b>Limax</b> .....         | 147          |
| <b>Halesia</b> .....        | 107      | <b>Limosa</b> .....        | 32           |
| <b>Helætus</b> .....        | 27       | <b>Limulus</b> .....       | 125, 129     |
| <b>Haliplana</b> .....      | 46       | <b>Lindernia</b> .....     | 157          |
| <b>Hamamelis</b> .....      | 295      | <b>Lingula</b> .....       | 125          |
| <b>Helicops</b> .....       | 222      | <b>Lingulella</b> .....    | 185          |
| <b>Helix</b> .....          | 147      | <b>Liocardium</b> .....    | 134          |
| <b>Hemidactylus</b> .....   | 218, 220 | <b>Liocephalus</b> .....   | 218          |
| <b>Hemiodus</b> .....       | 291      | <b>Liodon</b> .....        | 297          |
| <b>Hepatus</b> .....        | 124      | <b>Liophis</b> .....       | 204, 222     |
| <b>Herodias</b> .....       | 33       | <b>Liposarcus</b> .....    | 284, 292     |
| <b>Heros</b> .....          | 254      | <b>Liriodendron</b> .....  | 106          |
| <b>Herpetodryas</b> .....   | 204      | <b>Lithodytes</b> .....    | 216, 219     |
| <b>Heterocrinus</b> .....   | 308      | <b>Littorina</b> .....     | 141          |
| <b>Himantodes</b> .....     | 201      | <b>Loligo</b> .....        | 126          |
| <b>Hippa</b> .....          | 124, 240 | <b>Lonicera</b> .....      | 107          |
| <b>Hipparion</b> .....      | 112      | <b>Lophiodon</b> .....     | 9, 229       |
| <b>Hirundo</b> .....        | 21, 306  | <b>Loricaria</b> .....     | 289          |
| <b>Holcokus</b> .....       | 298      | <b>Loxonema</b> .....      | 174          |
| <b>Holopea</b> .....        | 172      | <b>Lucina</b> .....        | 62, 134      |
| <b>Holotaxis</b> .....      | 257      | <b>Lucinopsis</b> .....    | 137          |
| <b>Homalochilus</b> .....   | 218      | <b>Lupa</b> .....          | 239          |
| <b>Homarus</b> .....        | 124      | <b>Lutra</b> .....         | 13           |
| <b>Hoplosternum</b> .....   | 277      | <b>Lynx</b> .....          | 12           |
| <b>1872.]</b>               |          | <b>Lyonsia</b> .....       | 139          |

|                    |              |                     |                    |
|--------------------|--------------|---------------------|--------------------|
| Mabuia .....       | 223          | Ophiophragmum ..... | 148                |
| Macrocheilus ..... | 328          | Ophisaurus .....    | 48                 |
| Macrodon .....     | 257          | Opomola .....       | 151                |
| Macrorhampus ..... | 30           | Oreodon .....       | 248                |
| Mactra .....       | 137          | Orthoceras .....    | 172, 380           |
| Magnolia .....     | 103, 109     | Orthonema .....     | 81                 |
| Malacoclemys ..... | 49           | Ortyx .....         | 28                 |
| Mareca .....       | 36           | Osteoglossum .....  | 257, 291           |
| Marginella .....   | 143          | Ostrea .....        | 131                |
| Masticophis .....  | 204, 216     | Otocinclus .....    | 112, 283, 291      |
| Mastodon .....     | 50, 113, 198 | Oxybelis .....      | 216                |
| Megalobrycon ..... | 202, 291     | Oxyrrhopus .....    | 201, 216           |
| Megambonia .....   | 321          |                     |                    |
| Melampus .....     | 147          | Pachycheles .....   | 225                |
| Melospiza .....    | 22           | Palæmon .....       | 134, 225           |
| Menippe .....      | 120, 239     | Palæotherium .....  | 114, 118           |
| Mercenaria .....   | 134          | Palæosyops .....    | 114, 118, 197, 239 |
| Mergus .....       | 37           | Panæus .....        | 243                |
| Mesonauta .....    | 254          | Pandion .....       | 37                 |
| Mesops .....       | 527          | Pandora .....       | 139                |
| Mimulus .....      | 115          | Panopæa .....       | 189                |
| Mimus .....        | 19           | Panopæus .....      | 120, 239           |
| Mitchella .....    | 52           | Panulirus .....     | 225, 242           |
| Mithraculus .....  | 239          | Paramys .....       | 231                |
| Modiola .....      | 134          | Pariodon .....      | 55, 290, 292       |
| Modiolopsis .....  | 323          | Pariolius .....     | 289, 291           |
| Murchisonia .....  | 51, 175      | Parula .....        | 20                 |
| Murex .....        | 147          | Passerculus .....   | 21                 |
| Mus .....          | 14           | Pecten .....        | 131                |
| Mys .....          | 139          | Pectunculus .....   | 132                |
| Myalina .....      | 127, 139     | Pelamis .....       | 204                |
| Mylozetetes .....  | 234          | Pelecanus .....     | 37                 |
| Myletes .....      | 55, 267, 291 | Pelidna .....       | 30                 |
| Mysops .....       | 232          | Pellona .....       | 256                |
| Mytilus .....      | 134          | Peneus .....        | 124                |
|                    |              | Persephona .....    | 123                |
| Nassa .....        | 144          | Petricola .....     | 137                |
| Natica .....       | 142          | Petrolisthes .....  | 240                |

|                              |               |                              |               |
|------------------------------|---------------|------------------------------|---------------|
| <b>Podiceps</b> .....        | 47            | <b>Sciurus</b> .....         | 14            |
| <b>Podilymbus</b> .....      | 47            | <b>Scytopsis</b> .....       | 222           |
| <b>Podocnemis</b> .....      | 222           | <b>Sedgwickia</b> .....      | 71, 323       |
| <b>Poecilichthys</b> .....   | 259           | <b>Semele</b> .....          | 138           |
| <b>Polycera</b> .....        | 140           | <b>Semicassis</b> .....      | 143           |
| <b>Porthidium</b> .....      | 206, 207      | <b>Serrasalmo</b> .....      | 268, 292      |
| <b>Porzana</b> .....         | 35            | <b>Sesaima</b> .....         | 121           |
| <b>Poteroocrinites</b> ..... | 310           | <b>Sigaretus</b> .....       | 142           |
| <b>Procyon</b> .....         | 12            | <b>Siliquaria</b> .....      | 138           |
| <b>Phylodactylus</b> .....   | 205           | <b>Sinopa</b> .....          | 116           |
| <b>Physopyxis</b> .....      | 112, 273, 291 | <b>Smilisca</b> .....        | 205           |
| <b>Prochilodus</b> .....     | 258           | <b>Solarium</b> .....        | 141           |
| <b>Productus</b> .....       | 74            | <b>Solemya</b> .....         | 139           |
| <b>Proetus</b> .....         | 89            | <b>Solen</b> .....           | 138           |
| <b>Progne</b> .....          | 21            | <b>Soleniscus</b> .....      | 329           |
| <b>Protohippus</b> .....     | 50            | <b>Solenomya</b> .....       | 66            |
| <b>Pseudorhamdia</b> .....   | 269           | <b>Sphærodactylus</b> .....  | 216, 218      |
| <b>Pseudotremia</b> .....    | 297           | <b>Spilotes</b> .....        | 204           |
| <b>Pterinea</b> .....        | 162           | <b>Spirifer</b> .....        | 179           |
| <b>Pterophyllum</b> .....    | 250, 291      | <b>Squatarola</b> .....      | 29            |
| <b>Ptilodictya</b> .....     | 63, 160, 317  | <b>Stegophilus</b> .....     | 55, 290       |
| <b>Puffinus</b> .....        | 38            | <b>Stenorhina</b> .....      | 205           |
| <b>Purpura</b> .....         | 143           | <b>Sterna</b> .....          | 43            |
| <b>Putorius</b> .....        | 12            | <b>Sternopygus</b> .....     | 257           |
| <b>Pyranga</b> .....         | 21            | <b>Stethaprion</b> .....     | 261, 291      |
| <b>Pyrula</b> .....          | 145           | <b>Stictopora</b> .....      | 63            |
| <b>Quercus</b> .....         | 155           | <b>Strepsilas</b> .....      | 29            |
| <b>Querquedula</b> .....     | 36            | <b>Streptacis</b> .....      | 173           |
| <b>Quiscalus</b> .....       | 25            | <b>Strigilla</b> .....       | 138           |
| <b>Ræta</b> .....            | 137           | <b>Strix</b> .....           | 27            |
| <b>Rallus</b> .....          | 34            | <b>Strombus</b> .....        | 147           |
| <b>Rana</b> .....            | 49            | <b>Sturnella</b> .....       | 25            |
| <b>Ranella</b> .....         | 147           | <b>Stylemys</b> .....        | 248           |
| <b>Ranula</b> .....          | 222           | <b>Sula</b> .....            | 38            |
| <b>Rapana</b> .....          | 144           | <b>Symbranchus</b> .....     | 290           |
| <b>Raphidophora</b> .....    | 297           | <b>Symphemia</b> .....       | 32            |
| <b>Reduvius</b> .....        | 51            | <b>Symphysodon</b> .....     | 291           |
| <b>Recurvirostra</b> .....   | 33            | <b>Systema</b> .....         | 216           |
| <b>Renilla</b> .....         | 129           | <b>Tantilla</b> .....        | 204           |
| <b>Retzia</b> .....          | 318           | <b>Tania</b> .....           | 53            |
| <b>Rhadinea</b> .....        | 204, 212      | <b>Teleuraspis</b> .....     | 206           |
| <b>Rhyacophilus</b> .....    | 32            | <b>Tellina</b> .....         | 138           |
| <b>Rhinoceros</b> .....      | 10, 248       | <b>Telmatodytes</b> .....    | 19            |
| <b>Rhinodoras</b> .....      | 292           | <b>Testudo</b> .....         | 154           |
| <b>Rhynchops</b> .....       | 46            | <b>Tetragonopterus</b> ..... | 217, 260, 291 |
| <b>Roeboides</b> .....       | 55, 265, 292  | <b>Titanotherium</b> .....   | 114           |
| <b>Rubus</b> .....           | 296           | <b>Thalasseus</b> .....      | 43            |
| <b>Salix</b> .....           | 109           | <b>Thrasops</b> .....        | 200, 204, 218 |
| <b>Salmo</b> .....           | 305           | <b>Thryothorus</b> .....     | 19            |
| <b>Sanguinolites</b> .....   | 68            | <b>Torenia</b> .....         | 118, 157      |
| <b>Sauropleuræ</b> .....     | 53            | <b>Trachycephalus</b> .....  | 219           |
| <b>Scalaria</b> .....        | 141           | <b>Trichomycterus</b> .....  | 289           |
| <b>Scalops</b> .....         | 14            | <b>Triforis</b> .....        | 142           |
| <b>Sceloporus</b> .....      | 205, 216      | <b>Trigonocephalus</b> ..... | 208           |
| <b>Schizodus</b> .....       | 72, 165       | <b>Tringoides</b> .....      | 32            |
| <b>Sciuravus</b> .....       | 230           | <b>Trionyx</b> .....         | 154, 228      |
| <b>1872.]</b>                |               | <b>Triportheus</b> .....     | 263, 291      |
|                              |               | <b>Trochita</b> .....        | 82            |

|                    |          |                   |               |
|--------------------|----------|-------------------|---------------|
| Trochoceras .....  | 88       | Vermetus .....    | 141           |
| Trochonema .....   | 83       | Vireo .....       | 21            |
| Trogosus .....     | 115, 229 | Viviparus .....   | 183           |
| Trypheropsis ..... | 205      | Vulpes .....      | 12            |
| Turbo .....        | 141      |                   |               |
| Turbonilla .....   | 143      | Xenodermus .....  | 202           |
| Turdus .....       | 19       | Xiphophorus ..... | 217           |
| Tyrannus .....     | 26       | Xiphostoma .....  | 267           |
|                    |          |                   |               |
| Uarus .....        | 253      | Yoldia .....      | 133           |
| Uca .....          | 240      |                   |               |
| Ungualia .....     | 218      | Zathorax .....    | 112, 271, 291 |
| Unio .....         | 188      | Zenædura .....    | 28            |
| Utriculus .....    | 140      | Zizyphinus .....  | 141           |
|                    |          | Zonotrichia ..... | 22            |
| Vandellia .....    | 55       |                   |               |
| Verbascum .....    | 296      |                   |               |

## GENERAL INDEX.

Adams, Rev. E. E., Announcement of death of, 297.

Amendment of By-laws, 103.

Cavada, Gen. F. F., Announcement of death of, 297.

Cohen, J. J., M.D., Announcement of death of, 56.

Cope, E. D., Observations on *Sauropleura remex*, 53; On Fishes from the Amazon River, 55; On some of the Siluroids of the Amazon, 112; On the Fishes of the Ambyiaeu River, 117, 250; On Plectognathi and Lophobranchii, 157; Contributions to the Herpetology of Tropical America, No. 9, 198, 200; On a species of *Galeodes*, 295; On the Fauna of the Wyandotte Cave, 297; On fossil reptiles from the Cretaceous of Western Kansas, 297; On a peculiar habit in *Phrynosoma*, 305.

Correspondence during 1871, 348.

Coues, E., Notes on the Natural History of Fort Macon, N. C., and vicinity. No. 1; 9, 12. Same, No. 2; 112, 120.

Donations to the Library, 351.

Duméril, Prof. C., Announcement of death of, 102.

Dutton, Lieut., On Silurian and Devonian Brachiopoda, 112.

Election of officers, 346.

Elections during 1871, 347.

Gentry, Mr., On *Alyssum calycinum*, Linn., 111.

Holbrook, J. E., M.D., Announcement of death of, 237.

1872.]

Lea, I., Descriptions of twenty new species of Unionidæ of the United States, 157, 189; Description of three new species of Exotic Unionidæ, 188.

Lawrence, Geo. N., Descriptions of new species of Birds of the families Troglodytidæ and Tyrannidæ, 233.

Leidy, Jos., On a small collection of fossils from California, 50; Remarks on *Tænia mediocanellata*, 53; On some extinct Turtles from Wyoming Territory, 102; On Polydactylism in a Horse, 112; On remains of Mastodon and Horse in North Carolina, 113; Remains of extinct mammals from Wyoming, 113; Remarks on a fossil *Testudo* from Wyoming, 154; Remarks on supposed fossil Turtle Eggs, 154; Remarks on the Garnets of Green's Creek, Delaware Co., 155; Remarks on donation of fossils from Wyoming, 197; Remarks on Mastodon, etc., of California, 198; Note on *Anchitherium*, 199; Remarks on fossil Vertebrates from Wyoming, 228; Notice of some extinct Rodents, 230; Remarks on the Minerals of Mount Mica, 245; Remarks on fossils of Oregon, 247; Flies as means of communicating Contagious Diseases, 297; Notice of some Worms, 305.

Marsh, O. C., On a tooth of *Lophiodon*, 9; On new reptiles and fishes from the Cretaceous and Tertiary Formations, 103.

Marshall, Benj., Announcement of death of, 103.

Meehan, Thos., On a pear presenting the external appearance of an ap-



**BIOLOGICAL AND MICROSCOPICAL DEPARTMENT**  
**OF THE**  
**ACADEMY OF NATURAL SCIENCES.**

---

**JANUARY 16.**

**CONVERSATIONAL MEETING.**

**Prof. J. H. McQUILLEN in the chair.**

**Twelve members present.**

The attention of the Section was asked by Prof. James Tyson, to a simple diagram which he had been in the habit of using in his lectures, for several years past, to impress upon students the circumstances under which the reversal of lights and shadows takes place in red blood-corpuscles while under microscopic examination. The familiar "cracker shape" of the corpuscle being acknowledged, and supposing the entire corpuscle in focus when there is the least shadow, it is plain that the central portion is a double concave lens, while the periphery will act as a double convex lens. The centre of the corpuscle will therefore cause the parallel rays *r r r* to disperse and pass beyond the corpuscle,





in the text-book on physiology, but with the description reversed, and therefore correct. The corpuscle is, however, described as in focus when the periphery is in focus. Of the other text-books now within our reach, Dalton has it correctly on page 214 of his third edition; Flint, Kirke, Ranke in his "Grundzüge der Physiologie," and Stricker in his "Handbuch der Lehre von den Geweben," refer to the reversal of light and shadow, but do not state the circumstances under which it takes place. Marshall makes no allusion to it.

Dr. McQuillen exhibited five microscopical specimens prepared by Dr. George D. Harriman, of Boston, consisting of dentine, cementum, and bone, which had been acted upon by dilute muriatic acid removing the earthy salts and leaving the cartilaginous basis of which those structures are composed, the latter of which had then been stained with carmine. These specimens had been prepared with a view of demonstrating that dentine does not consist of tubular and intertubular structures; also that in cementum and bone the lacunæ and canaliculi are not empty spaces, but occupied by a soft solid body or substance.

---

FEBRUARY 6.

Director S. W. MITCHELL in the chair.

Sixteen members present.

Mr. William H. Walmsley exhibited slides showing the difference between the torn edge of our ordinary paper and that of the thick, strong paper used by the Chinese for the manufacture of clothing. Both appeared to be composed of cotton, but the foreign article bore the aspect of being made directly from the cotton fibres, instead of from comminuted woven fabrics.

Dr. McQuillen directed attention to a remarkable specimen of hypertrophy of the roots of a left superior molar measuring  $2\frac{1}{2}$  inches in length by  $2\frac{3}{4}$  inches in circumference, and weighing  $12\frac{1}{2}$  dwts. (Fig. 1), which he had exhibited at a previous meeting and of which he had promised to make a microscopical examination. This he had done, and now sub-

Fig. 1.





in a spiral direction analogous to dentinal tubuli in secondary dentine.

Dr. F. W. Lewis inquired what difference there was between these exostoses and epulis.

Dr. James Tyson remarked that, microscopically, true epulis is a fibrous tissue, and springs from the mucous membrane, although the giant-celled myeloid tumor (giant-celled sarcoma of Virchow) generally springs from bone, and is sometimes incorrectly called epulis. With regard to the nature of cementum, Dr. T. suggested that it seemed more philosophical to place it in the same category with bone, since it only differed from true osseous tissue in the absence of Haversian canals for minute bloodvessels, which were unnecessary on account of the close contiguity of the structure (cementum) to its vascular supply.

Dr. Tyson also showed an ingenious *gastric canula*, improved by himself by the addition of a cover and catch for preventing the loss of gastric juice, an accident which is constantly occurring with the ordinary canula in consequence of the animal's scratching out the cork after the instrument is adjusted in the fistula from the stomach.

---

#### FEBRUARY 20.

#### CONVERSATIONAL MEETING.

Seven members present.

---

#### MARCH 6.

Director S. W. MITCHELL, M.D., in the chair.

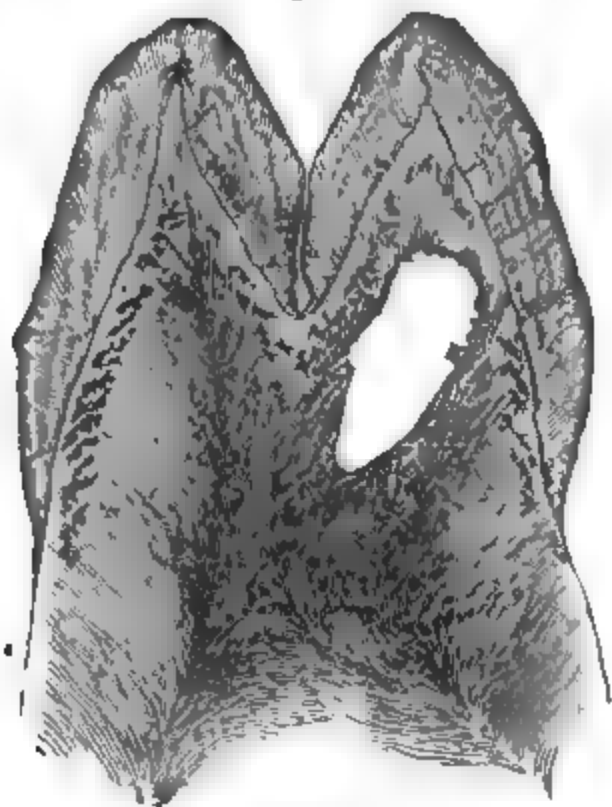
Eight members present.

The Corresponding Secretary presented photographs of the test Diatoms *Surirella gemma* and *Amphipleura pellucida* (the latter exhibiting 91,000 striæ to the inch) from Col. J. J. Woodward, of the Army Medical Museum at Washington, and moved a vote of thanks for the same, which was carried unanimously.

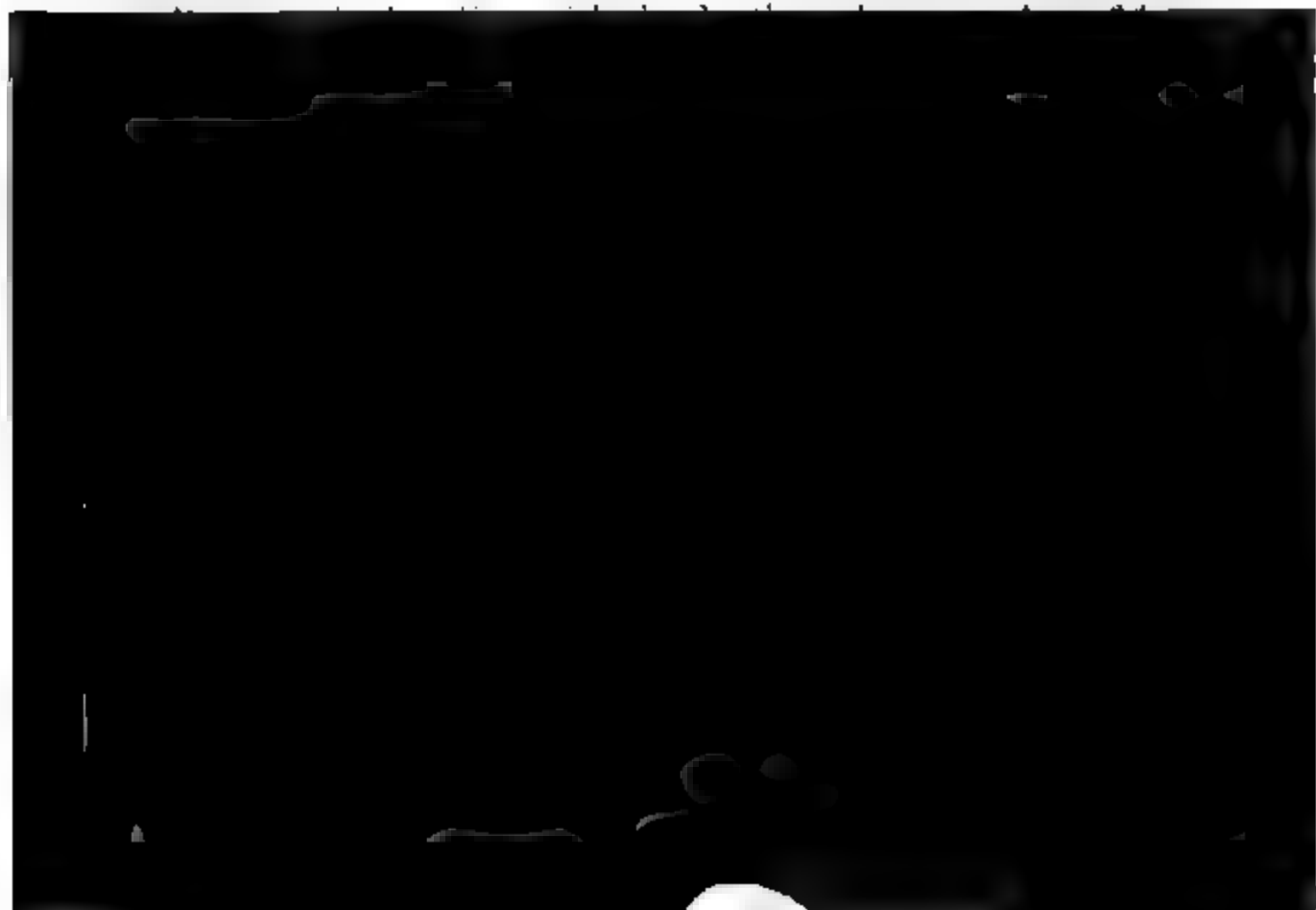
Dr. J. H. McQuillen exhibited half a dozen microscopical slides, handed to him by Dr. R. W. Varney, of New York, viz.: Transverse section of the maxilla of a cat, with the incisors, canines, and molar teeth in position; nodules of secondary dentine; sec-

tion of hypertrophied root of a molar tooth; hemipterous insect (*Tingis arcuata*); longitudinal section of a deciduous incisor and of a molar tooth. Dr. McQuillen directed particular attention to the last-named specimen as having a practical significance bearing upon the diseases and treatment of the teeth. Under the microscope a fissure (Fig. 3) inappreciable to the naked eye could

Fig. 3.



be seen passing through the enamel and enlarging into an oval



APRIL 3.

Director S. W. MITCHELL, M.D., in the chair.

Eight members present.

A donation from the Surgeon-General's office of Dr. J. J. Woodward's interesting report, entitled "A Memorandum of the Test Podura, with Five Photo-micrographs," was received.

Dr. James Tyson exhibited slides of the deposit from two specimens of urine from a so-called *intermittent hæmaturia*, which were interesting, if not important, from the fact that the first specimen, though containing granular casts, did not contain blood-corpuscles, and that the second, between which and the first the urine had become quite clear, contained, in addition to granular casts, blood-corpuscles and blood-casts. The importance of this observation lies in the circumstance that in the cases of intermittent hæmaturia reported by Harley (*Medico-Chirurgical Transactions*, vol. 48, 1865), blood-corpuscles were exceedingly rare, being found in but a single case, and not more than one or two in the field of the microscope. So rarely, indeed, have corpuscles been present, that Dr. Beale, in the first volume of the *Practitioner*, August, 1868, says that "it is therefore improbable that in these cases there is any hemorrhage as in acute inflammation of the kidneys, and they ought not to be spoken of as cases of hæmaturia."

In the present case all the other phenomena of intermittent hæmaturia attend, and in the second specimen of urine there are many free blood-corpuscles and blood-casts, while in the first the most careful searching detected none.

The treatment found most useful in intermittent hæmaturia, that by antiperiodic doses of quinia, preceded by a purgative dose of calomel, has been the most satisfactory, there being no recurrence since its adoption, although three weeks have elapsed, while other modes of treatment adopted since October, 1870, when the affection first appeared, have signally failed.<sup>1</sup>

Dr. Joseph G. Richardson exhibited a slide charged with *pulmonary elastic tissue* from the boiled sputa of a phthisical patient in the Episcopal Hospital, and called the attention of the

<sup>1</sup> July 1st, 1871. The patient has since quite recovered under this treatment.

Section to some characteristics of the elastic fibres, to wit, first, the Delta ( $\Delta$ ) rather than simple Y shape frequent among the fragments, which he attributed to the greater resistance at the meeting-point of the walls of three air-vesicles to any disintegrating process; and second, the transverse fracture of its component elastic filaments, resembling that of an India-rubber thread, instead of displaying a frayed-out appearance similar to that presented at the extremity of a broken cotton or linen string.

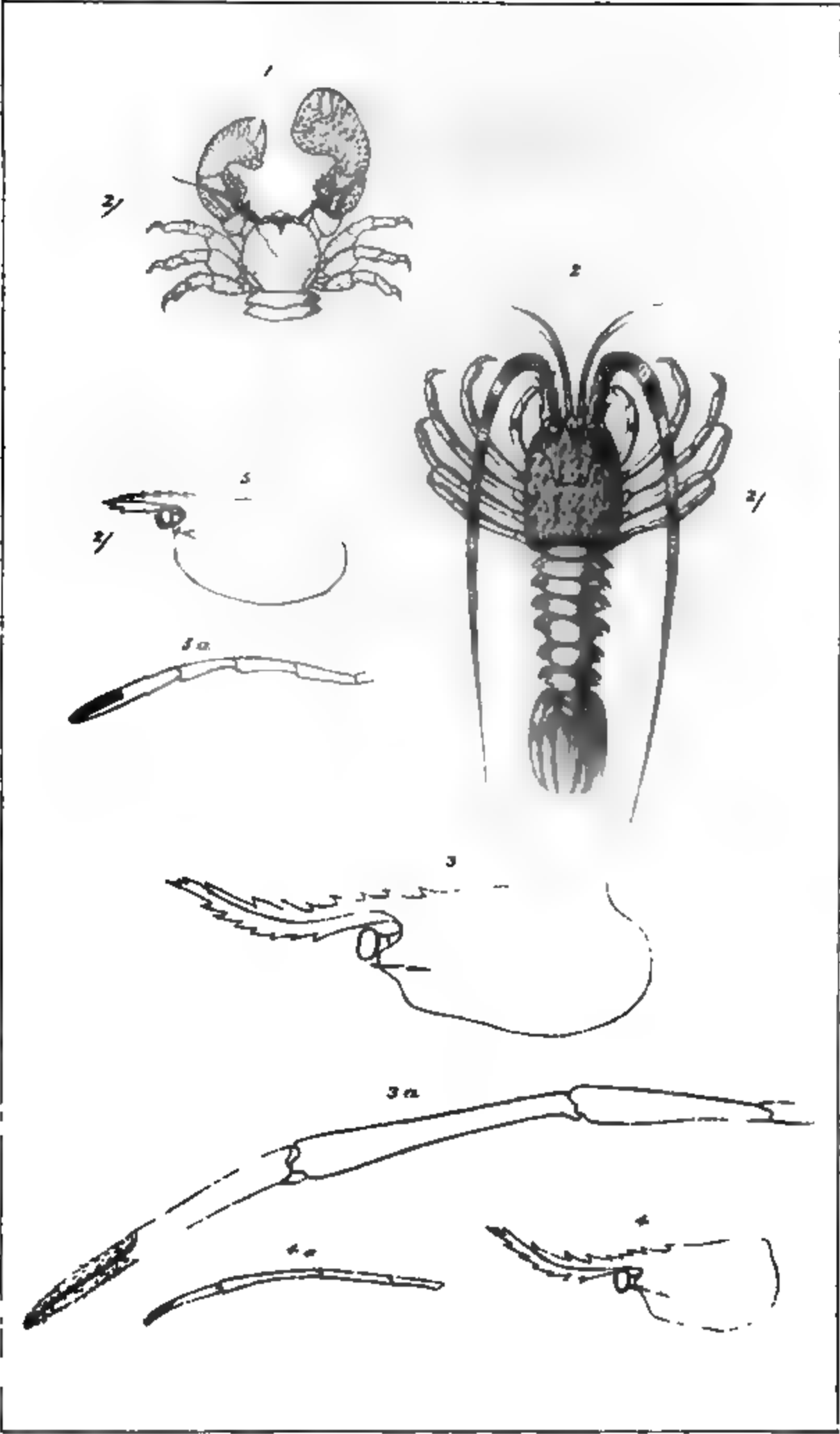
By these peculiarities pulmonary elastic tissue can generally be distinguished from folds in the walls of boiled-starch corpuscles; from mycelial threads of fungi (which, when dichotomous, often have stem and branches of nearly the same size); and from vegetable fibres, which seldom break transversely, and which, when split, generally assume the Y and not the *Delta* shape. (*Vide paper on the Detection of Lung Tissue in Sputum, in the New York State Medical Society's Transactions for 1871.*)



WILLIAM T. SWAILWOOD

*Chettusia nevifrons, Ogden.*





HARMAN T. SMALLWOOD

*Studies on New Mexican Crustacea.*

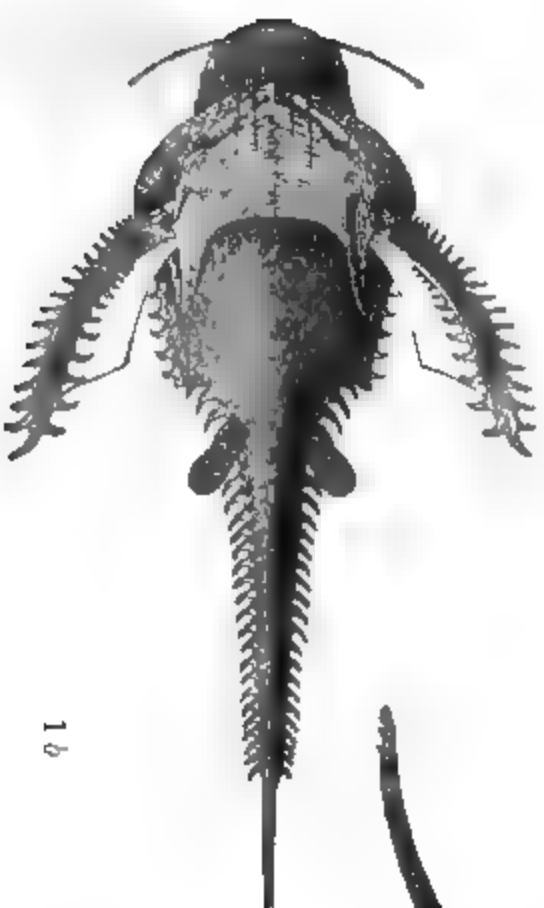
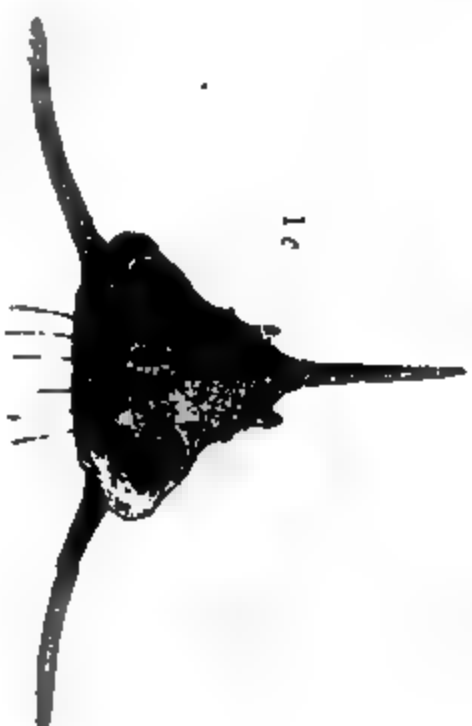
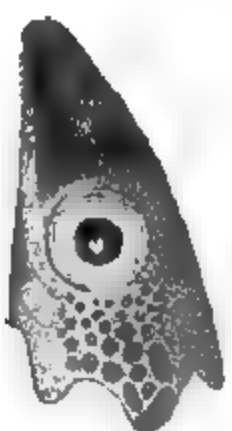
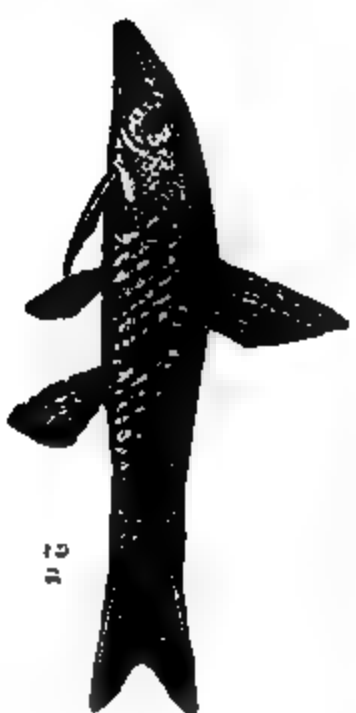
•

1

100





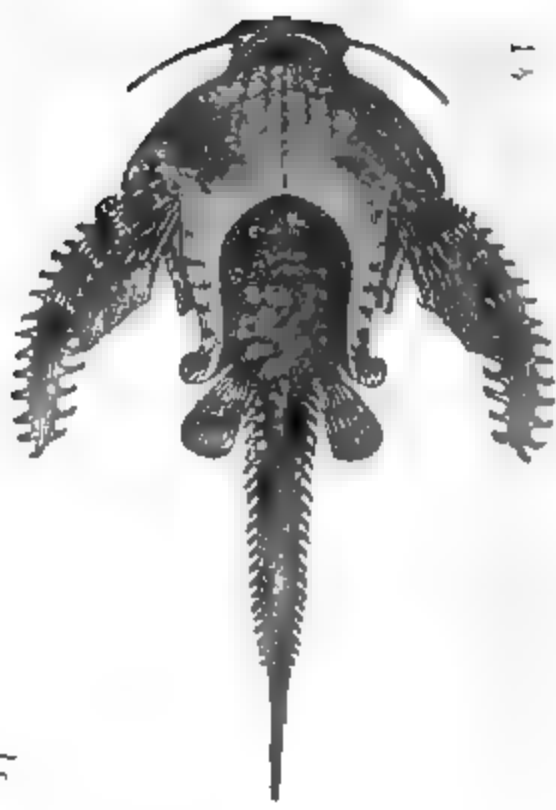


1. *Zanthopterus monilis*, Cope. 2. *Glaciocetus retusus*, Cope.

1

2

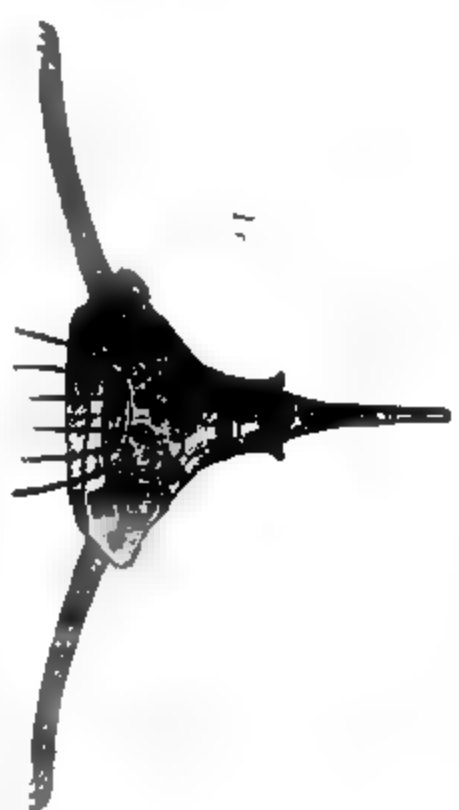
1b



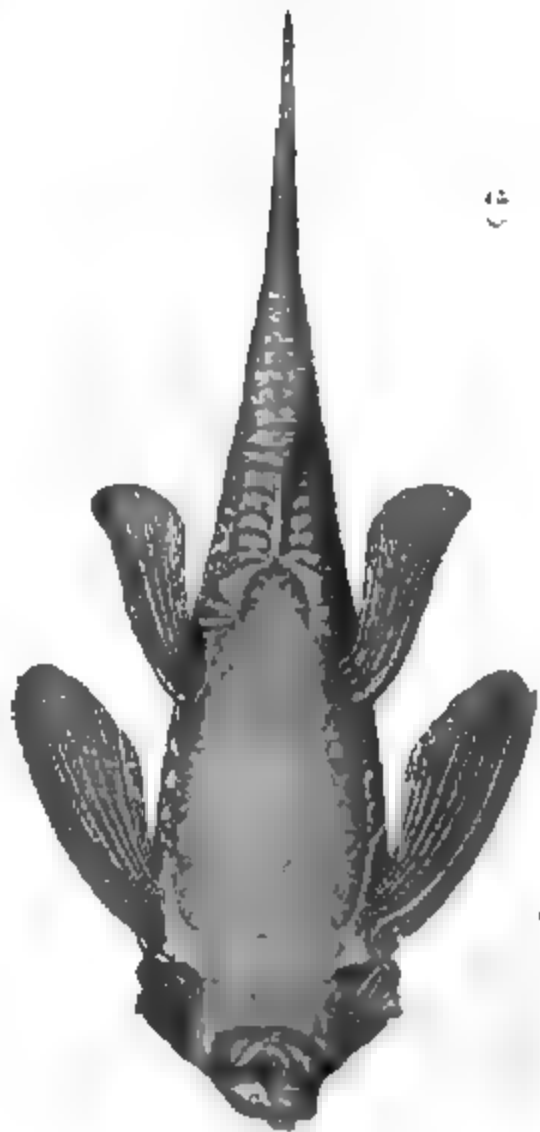
1a



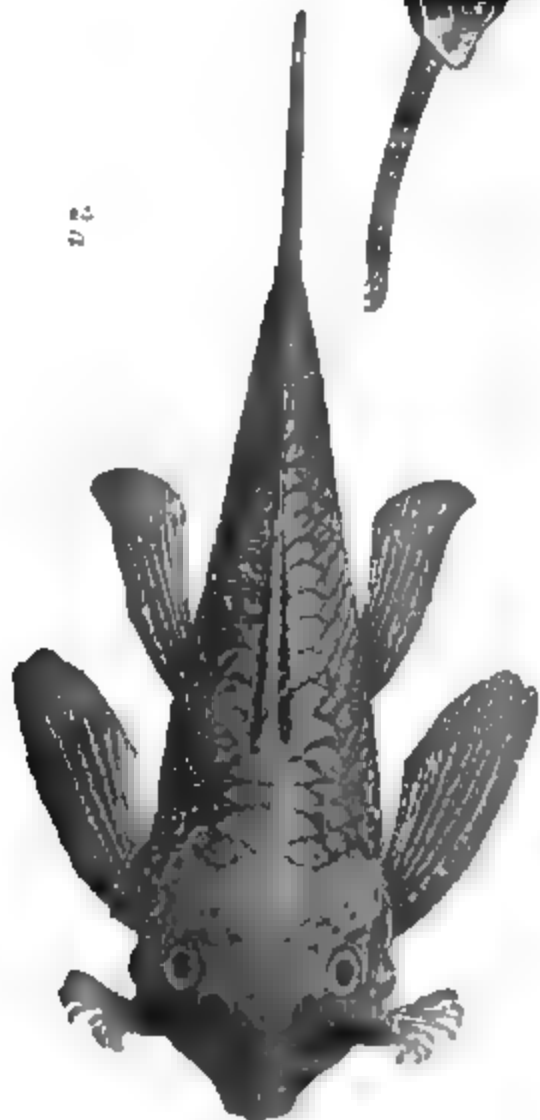
1c



2b



2a



Pl. V.

1. *Physoglypis lyra*, Cope. 2. *Chaetostomus multiceps*, Cope.

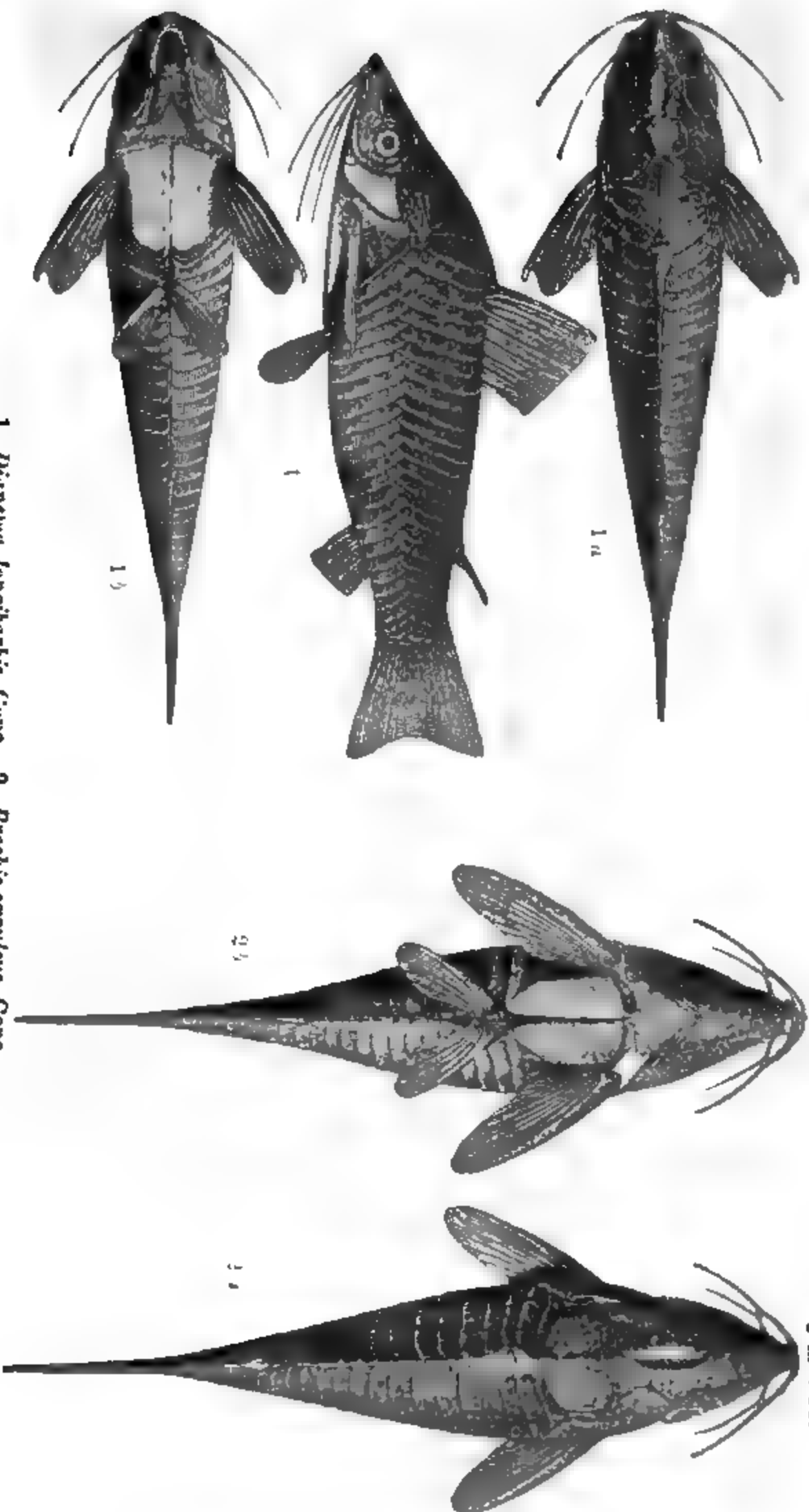




*Salmo gairdneri*

*Megachasma carolinense*

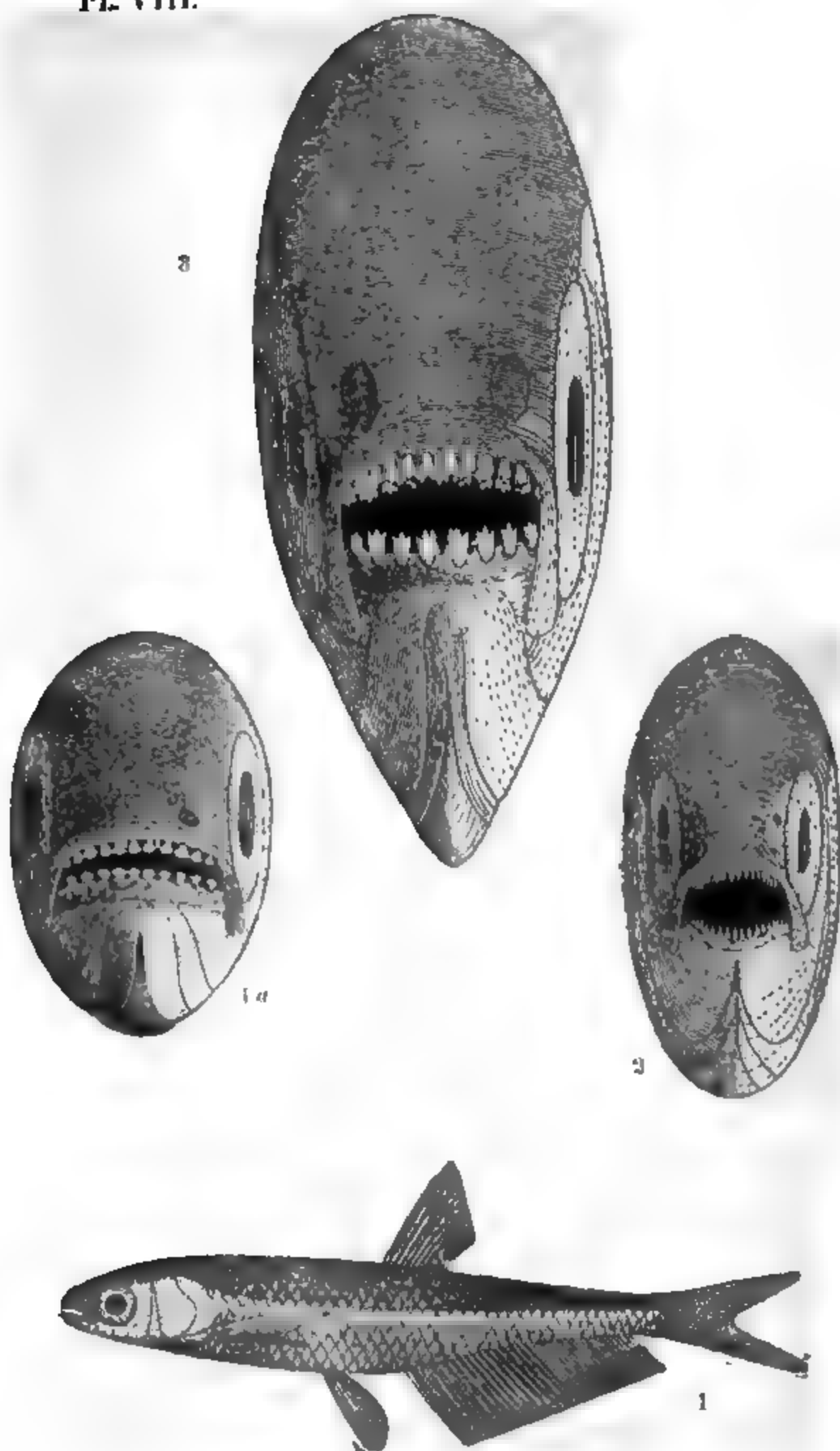




1. *Mianemus longibarbis*, Cope. 2. *Brochis caruleus*, Cope.

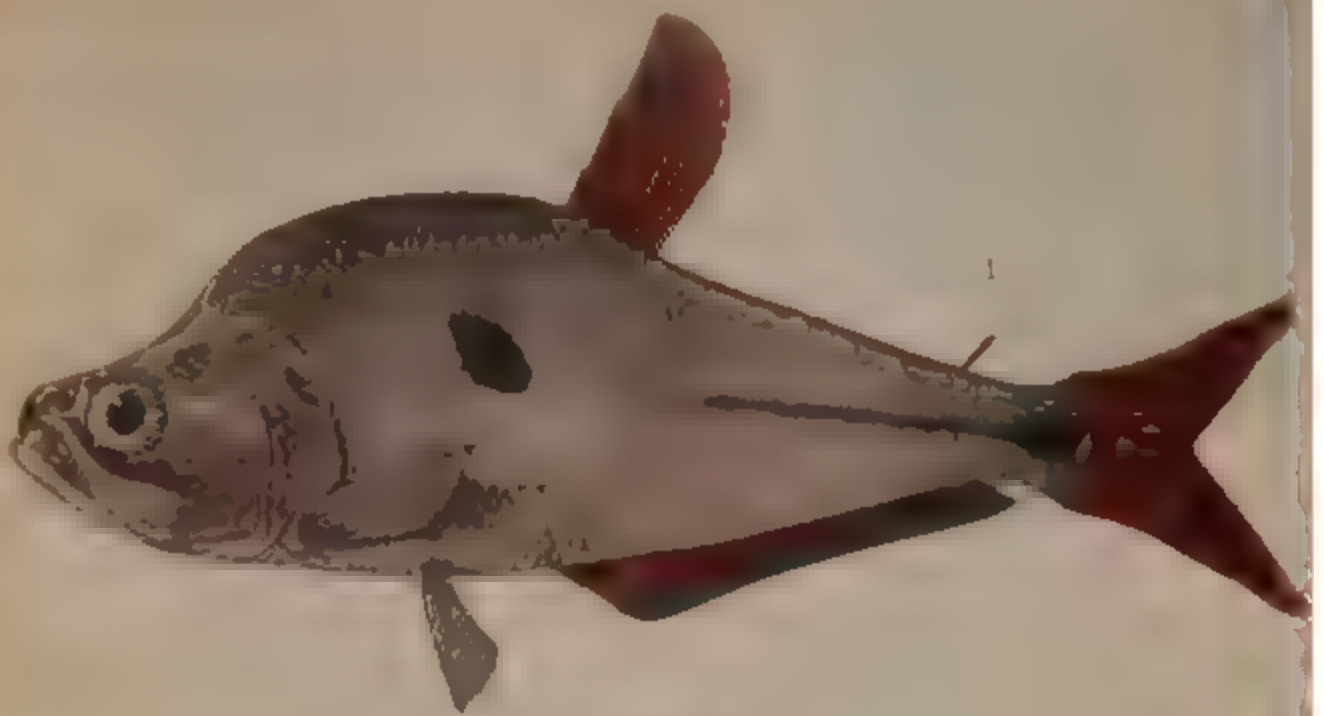


PL. VIII.



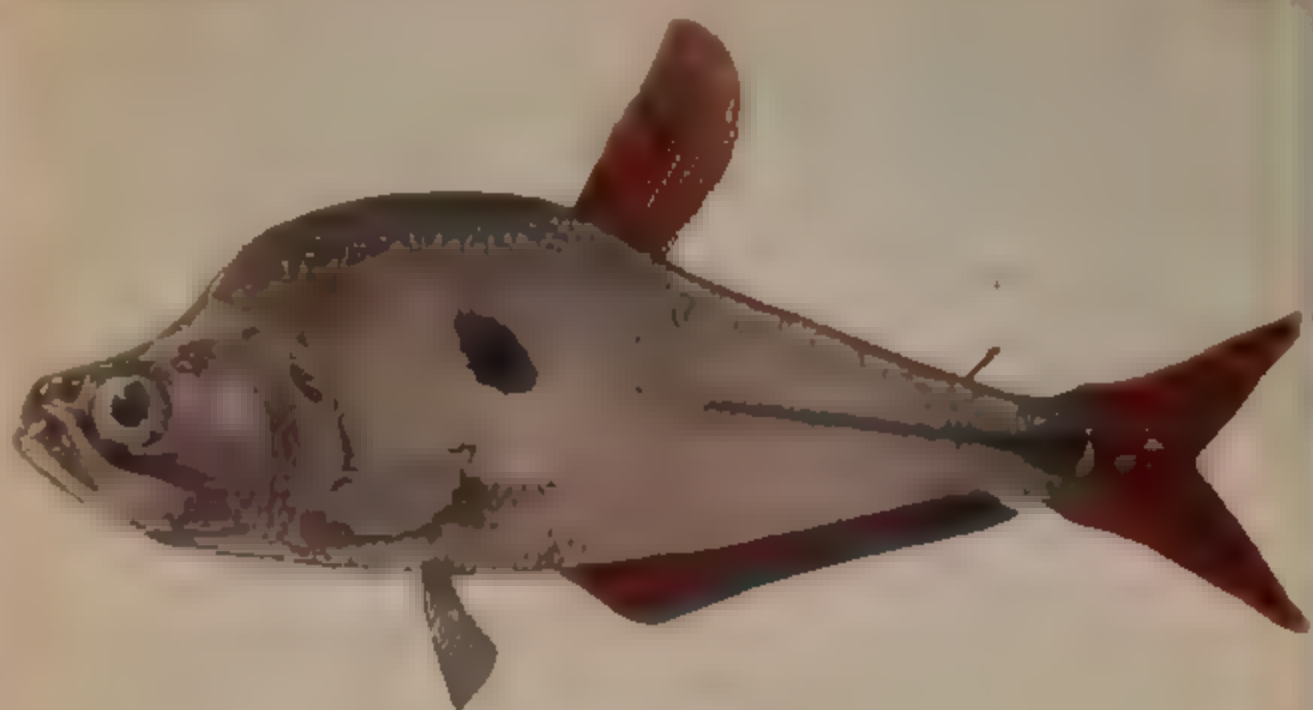
1. *Iguanodectes tenuis*, 1a. Dentition. 2. *Characidium otheostoma*, dentition. 3. *Triportheus albus*, dentition.





1. *Thalassoma surmuletus* 2. *Serranus alpinus* 3. *Thalassoma*





*Thalassoma* *variegatum* 2. *Serranodon* *trispinosus* 1. *Yucca* *glauca*

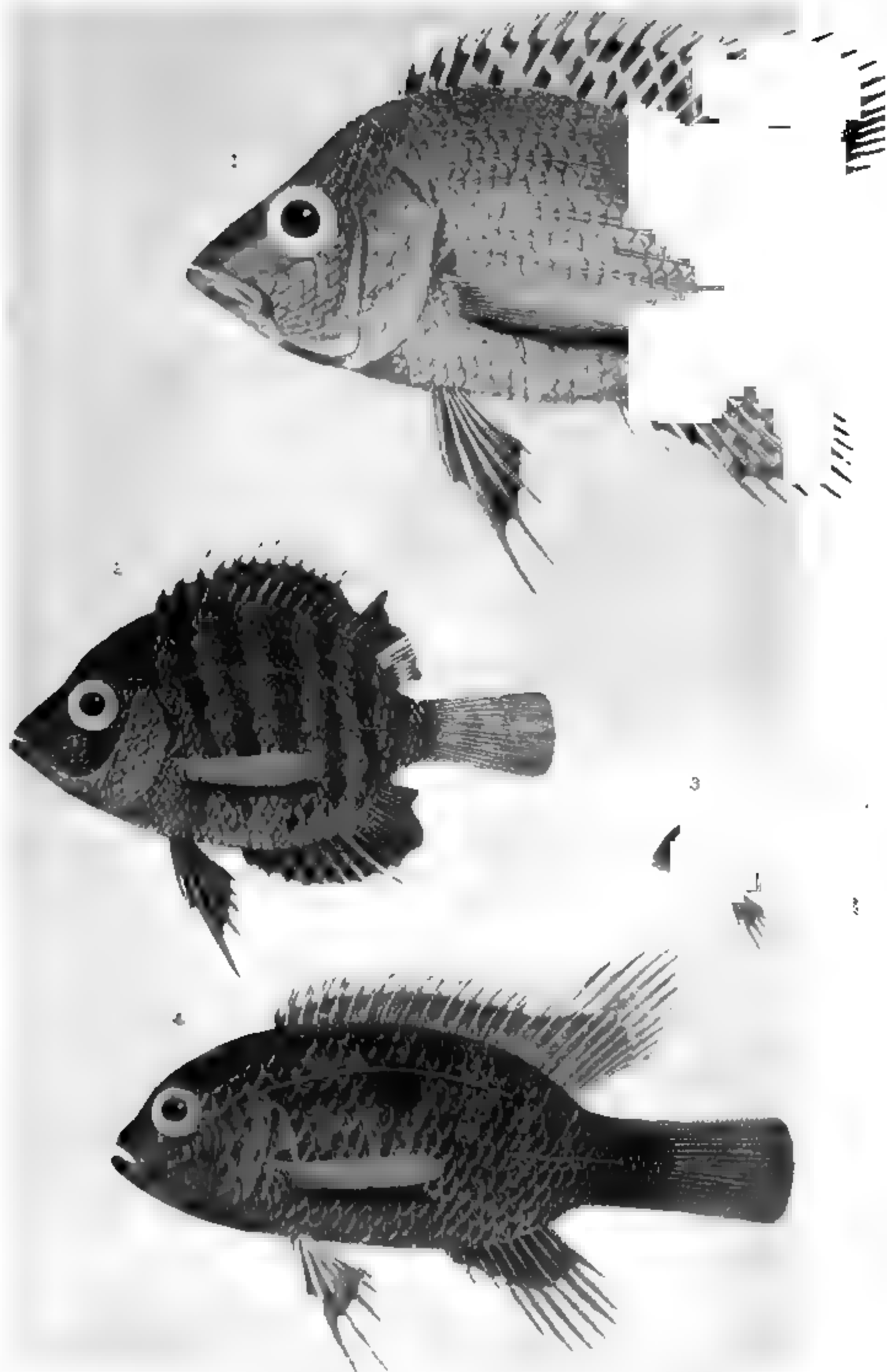
collected by the U.S.N.

Handwritten text, likely bleed-through from the reverse side of the page. The text is illegible due to the quality of the scan and the orientation of the page.

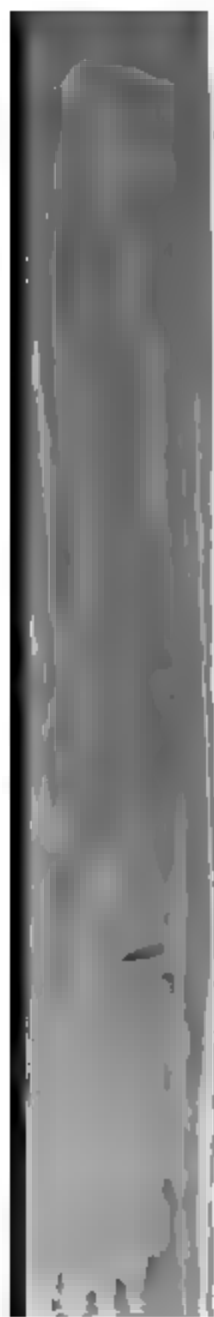


*Myopodopsylla* *Myopodopsylla*





1. *Geophagus burtipinnis*. 2 *Varuscentrarchoides*. 3 *Acara sypilax*  
 4. *Acara flavilabris* Cope.





*Plecostomus supataurus* Cope

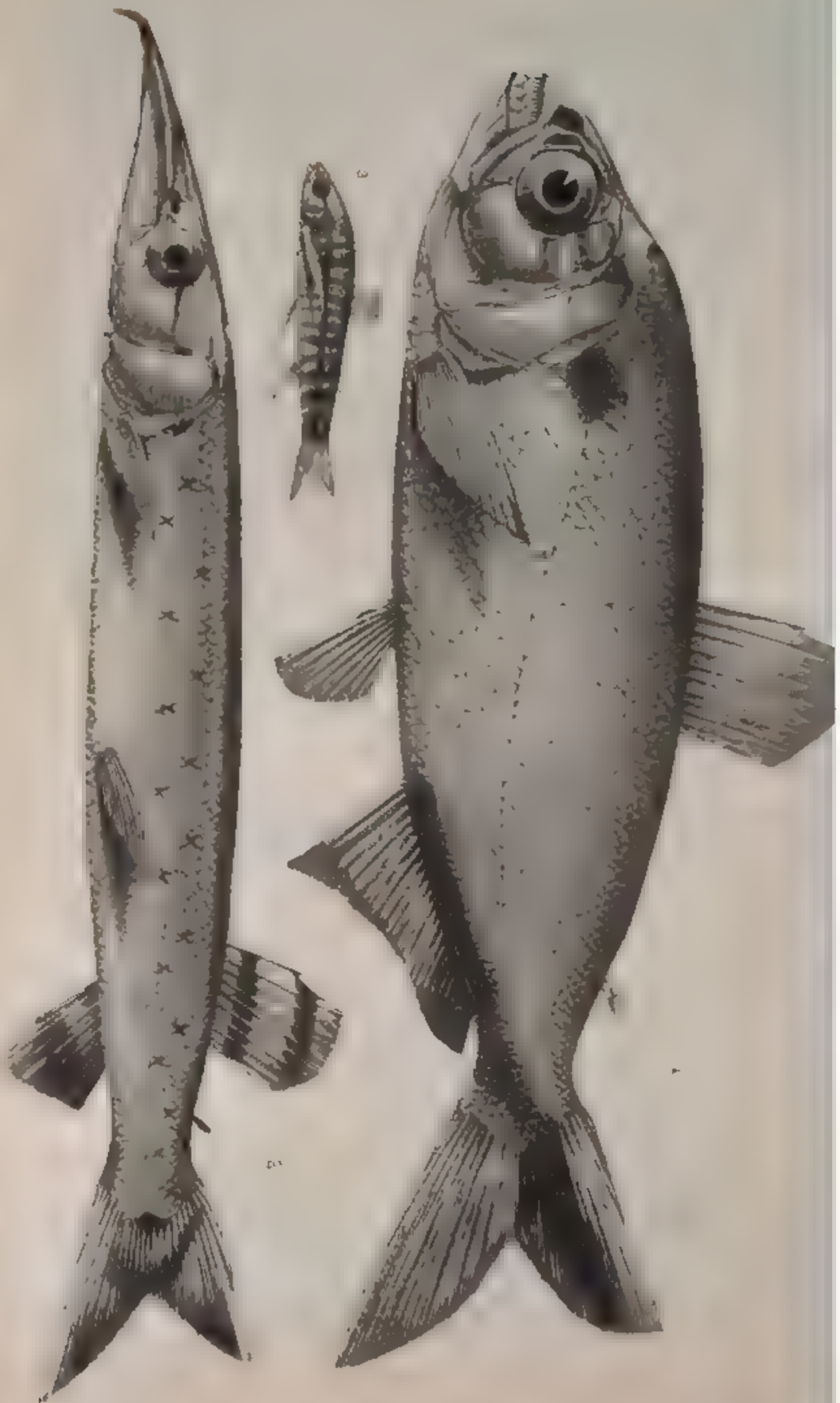




1 *Megalobrycon melanopterus* 2 *Xiphistoma luedo* 3 *Citharacidium citharistom*

1 cm = 1 mm





*Megolobrycon melanopterus* 2 *Xiphostomus luedo* 3 *Chasacidium rheostomum*





1 *Pareuchanna*. 2 *Chaetostomus leucostriatus* 3 *Chaetostomus*





*Plecostomus supalarius* Cope.

